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CONTENTS

DIESEL RAILWAY TRACTION

A Supplement illustrating and describing developments in Diesel Railway Traction is presented with every copy of this week's issue

The Road-Rail Problem in Canada

COMPETITION between road and rail in Canada formed the subject of a recent address by Mr. S. W. Fairweather, Director of the Bureau of Economics, Canadian National Railways, in which he referred to an aspect of the problem that he considered had not received the attention it deserved, namely, the clash between two systems of rate making, the one developed by the railways based on value of service, and the other by highway carriers based on cost of service. The low railway rates for basic commodities conveyed over great distances were made possible only by charging comparatively high rates on high value and short haul commodities. Development of highway transport had broken this arrangement by exposing the profitable business of the railways to highway competition. Mr. Fairweather reviewed the various methods adopted in different countries for safeguarding the railways against this form of competition, all of which are, of course, restrictive in greater or less degree. The English attack on the problem, in which the agreed charge had been developed, was one which he advocated for consideration in Canada; but this, too, is restrictive in curbing the expansion of road traffic, although it may encourage co-operation between the two types of transport each within its legitimate sphere. In all the discussions of this problem no attention yet appears to have been given to the possibility of an expansive instead of a restrictive remedy. If the stimulation of ultimate demand so as to occupy fully and remuneratively all forms of transport were clearly specified as the reasonable objective, economists might then be charged with working out how to achieve it.

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Ticket Analysis

In a paper entitled "Some Phases of Operation on the Underground Railways of London" recently read before the Railway Students' Association, Mr. Evan Evans, Operating Manager (Railways), London Passenger Transport Board, referred to some remarkable economies effected by the board after reviewing the methods of issuing underground railway tickets. As an example of the system of ticket "grouping" subsequently adopted, he mentioned that at Holborn a 2d. ticket now covers no fewer than 26 points. Without this grouping at least 15 tickets would be needed for the same purpose. At Bow Road station in 1926, 1,450 sets of tickets were stocked. Today, in spite of extensions to the board's railway system, this number is 174. With the use of the ticket-issuing machines, which is facilitated by the group ticket, it is possible with an eight-unit installation to cover 57 per cent. of the total issue of an office and, by making five units interchangeable for the issue of workmen's tickets, 97 per cent. of the total can be covered. The various devices introduced in recent years to simplify and speed-up the work of booking offices, Mr. Evans stated, had enabled an increase of 70 per cent. to be made in the rate of issuing tickets, 17 a minute, instead of 10, now being possible. The part played by the machine in this phase of operation is indicated by the fact that 83 per cent. of the board's total annual issue of 309 million railway tickets are issued by office or coin-operated installations.

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Fare Increases and Traffics

An examination of the Ministry of Transport statistics for the last three months of 1938 for all British standard-gauge railways (except London Transport and the Whitechapel & Bow) gives some indication of the effect of the 5 per cent. increase in fares which came into force in October. During those three months the number of passengers carried (exclusive of season ticket holders) was 205,566,569, a decrease of 3,443,845 or 1·65 per cent. The fares of £10,987,501 received from these passengers, however, showed an increase of £560,149 or 5·37 per cent. Standard fare passengers during the same period numbered 21,182,035, a decrease of 398,772 or 1·85 per cent., but the fares they paid amounted to £1,599,525, an increase of £54,747 or 3·54 per cent. The number of first class ordinary passengers carried during the last quarter of 1937 was 3,714,534, a decrease of only 8,091, but their fares produced £996,655, an increase of £77,113 or 8·39 per cent. Second class numbers in October were up 6·08 per cent. and receipts 33·36 per cent. Monthly return ticket numbers were slightly less in October and November, and slightly up in December, but the respective percentages of increase in receipts therefrom were 5·27, 7·93, and 8·03. Day, half-day, and evening excursions showed a fall in numbers in October and November but a slight advance in December, and the receipts of £3,109,323 for the three months were higher by £68,832 or 2·26 per cent.

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Brooklyn-Manhattan Transit

The annual report of the Brooklyn-Manhattan Transit Corporation for the year ended June 30, 1937, says that while gross receipts have decreased during recent years, labour costs and taxes have steadily risen. Gross operating revenues for all lines, including those of the Brooklyn & Queens Transit Corporation and its subsidiaries,

amounted to $51,987,039, compared with $52,464,854 in 1935-36. Operating expenses (including depreciation) were $34,332,481, against $33,949,957. Taxes amounted to $5,887,657 and interest, amortisation, rentals, &c., to $7,881,697 against $4,865,831, and $8,988,746 respectively in the previous year, leaving a surplus of $4,508,462, as compared with $4,997,588. The number of passengers on all lines, rapid transit, trolley, and bus routes, was slightly less, at 1,021,342,782, the number in 1935-36 having been 1,030,912,124. Taxes charged to operating expenses for the fiscal year 1937 were equivalent to $8 a share of the common stock, and the ratio to operating revenue was approximately 11·3 per cent., as compared with 6·5 per cent. for the fiscal year 1930. During the fiscal year 1937, payrolls amounted to $20,573,000, which was approximately 40 per cent. of the gross operating revenue. The 10 per cent. cut made in 1932 was fully restored, and vacations of one week with pay granted, such vacations adding approximately 2 per cent. to the labour cost. Under the refunding plan described in the last report, interest rates on funded debt were reduced, effecting a reduction in interest payable of over one million dollars, but because of increased cost of labour and taxes the surplus showed a decrease of over $489,000. Therefore, the saving accomplished by refunding has been more than absorbed by heavier labour costs and increased taxation.

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The Sorocabana Railway in 1936

Thanks to more peaceful conditions and greater political stability in Brazil, the receipts of the Sorocabana Railway totalled 121,870 contos of reis, in 1936, an increase of 16·27 per cent. over those in 1935, and the highest yet recorded. As working expenses rose by only 10·35 per cent. to 92,695 contos, net operating revenue was 29,175 contos, also a record. As, however, 1·5 per cent. of the total receipts had to be contributed to the Staff Pension Fund, the final net revenue available was 27,347 contos. Accounts for the Santos—Juquia line were kept separate, and showed a loss on working of 1,291 contos, a disappointing result in view of the improvements effected and the extension of the line to Registro. The Road Transport Department of the system continued to combat competition effectively, and receipts from it improved by 60·15 per cent. as compared with the previous year. The 27,347 contos revenue was devoted to the improvement of workshop equipment and to the continuation of the Mayrink—Santos construction, and a sum of 10,020 contos was allotted from the 10 per cent. Improvement Fund to new works and rolling stock. The above construction, which has subsequently been completed, had cost altogether 280,467 contos by the end of 1936, of which sum its 32 tunnels had absorbed 71,152 contos; the expenditure during the year, including the purchase of 120 km. of rails, was 19,874 contos.

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Alaska Railroad Results

The Alaska Railroad, owned by the United States Government, had a gross operating revenue in 1937 of $1,955,502, an increase of 4·65 per cent. over the figure for 1936. The operating expenses amounted to $1,966,174, an increase of 4·1 per cent., but included in this sum was $7,448 for a special investigation of mineral and other resources. Most of the increased expenditure—$60,049—was due to a higher wages and salaries bill, owing to the application of leave legislation which applied to practically all employees, but increased cost of materials also raised the expenses. Partly as a result of the cessation of the boat service to Alaska during the maritime strike, the number of passengers carried decreased by 15,406, and the passenger receipts by $34,702, or 15 per cent., but there was also a falling-off in short-distance passengers. The freight tonnage handled increased by 6,700, and the freight earnings by $110,689, or 8·25 per cent. No less than 83 per cent. of the total operating expenditure was accounted for by wages and salaries. Among the important works undertaken in 1937 were the replacement of a wooden bridge over the Knick river, by steel spans on creosoted pile piers, at a cost of $235,000, and the building (not yet finished) of a new hotel at the McKinley national park. A report of the National Resources Committee, transmitted to the U.S. Congress recently, recommends that the construction of new railways in Alaska should be delayed pending the formulation of plans for the general development of the country, but the committee did not believe that any new lines which were begun should be expected to pay their way completely.

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Building an Exhibition

The President of the forthcoming New York World's Fair, Mr. Grover A. Whalen, gives high praise to the American Railways by stating that " The fair could not be brought into existence without railroad aid. Nor could it ever have the least hope of success, even after its creation, without their continued existence." He instanced the possibility of a complete cessation of work upon the administrative building for 700 officers and executives of the fair and their staffs, owing to the foundations having been completed a fortnight before the contract date for the delivery of steel for its framework. As the result of a request, the steel was loaded and forwarded attached to milk and fruit trains, with the result that not a day was lost. The building was completed and ready for occupation in 124 working days —a record. The railways are expected to bring millions of visitors to the fair, and 34 lines have joined to rent 676,888 sq. ft. of space at a cost of $97,438, plus $1,500,000 for the erection of the largest building in the fair, exhibits, and a pageant. It is indicative of the many-sided activities of the railway industry that Mr. L. G. Coleman, Director of the World's Fair Committee of the Eastern Railroads Presidents' Conference, has been able to say that " the railroad exhibit, in itself, will be a miniature world's fair."

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Railway Speed Records

A letter from a correspondent in this issue concerns the evidence upon which is based the claims, subject afterwards to widespread and continuous publicity, that on such-and-such a test run the highest speed on record—usually for not more than a quarter or half a mile—was attained. The conflict of evidence here is between a record which was published in detail nine months ago—and in detail which in itself would seem to have provided confirmation of its accuracy by the logical continuity of its speeds —and a claim now made that the speeds were actually higher. The log to which reference is made was the work of several independent observers presenting agreed figures; the subsequent correction appears to be based on the speed curve of the self-recording indicator on the locomotive. Our correspondent draws attention to the meticulous care with which accuracy is ensured in measuring speed records in other realms of transport, and suggests that the railways should in future take special precautions for assuring the accuracy of their own, which in the higher ranges require progressively greater care to establish. Whether the last word is his suggested panel of competent speed recorders of recognised impartiality to travel in the train and time it by means of stop-watches from quarter-mileposts, or whether some reliable mechanical

means of timing might be adopted, we agree that, with the greater publicity now being sought for railway speed, the railway authorities would be well advised to treat the subject more seriously and less controversially.

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Cost of Speed Restrictions

The effect of a 30 m.p.h. speed restriction half a mile long is much more serious to high-speed trains than to those booked at the lower speeds almost universal until the recent tendency to accelerate train services. In a contribution to our American contemporary *Railway Engineering and Maintenance*, Mr. Robert Faries, Assistant Chief Engineer, Maintenance, Pennsylvania Railroad, remarks that it takes from two to three times the distance from the start of retardation for such a restriction to restoration of full speed when running at 90 m.p.h. as compared with 75 m.p.h. In a run of 100 miles the elimination of five or six such speed restrictions accomplishes the same result as an increase in speed from 75 to 90 m.p.h. As the speed increases, the effect of restrictions increases rapidly and particularly hinders heavy trains which cannot regain full speed so quickly as light trains. The elimination of speed restrictions or the reduction of their severity may thus have an important effect on the economy of working, for example, by eliminating double heading or making possible an increase in train loading with the same motive power. Alternatively overall speeds could be increased. Thus in estimating the cost of carrying out such work to the permanent way the ultimate savings effected by other departments should be included. Properly also a certain sum should be placed to the credit of the account for the improvement to the amenities of the railway from the passenger viewpoint, although such an item is at present regarded as intangible.

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Steamers on Lake Constance

Just over 100 years ago, on September 6, 1837, the first Bavarian steam vessel to ply regularly on Lake Constance was launched. This boat, which was named *Ludwig* after King Ludwig I of Bavaria, was not the first to be seen on the lake as a company had been formed in Württemberg 13 years earlier. That undertaking had shortly afterwards begun a service between Friedrichshafen and Rorschach in Switzerland, and in 1830 a Baden concern put some vessels to work. The Bavarian boat *Ludwig* was constructed through the efforts of a merchant, Eduard von Pfister, and the machinery was built by Fairburn of Manchester. Although the vessel unfortunately grounded at the launch, she was able to make her first trip on October 10, 1837, to Constance and attracted some attention owing to her iron hull. In March, 1861, she was lost after a collision with a Swiss boat during a snow storm. The Bavarian government took over the concern in 1862 and built some excellent boats, some of which did service for many years, such as the *Wittelsbach*, built in 1879 and withdrawn in 1928. In common with the services run by other German States, the Bavarian undertaking was absorbed in 1920 by the Reichsbahn. Of recent years screw motor vessels have replaced some of the paddle steamers. An account of the services on the lake, which form an important element in local transport facilities, was published in our issue of October 19, 1934, page 632.

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New American Diesel Flyers

For some time past competition has been keen between certain American railways in the installation of high-speed trains with diesel-electric propulsion; but the new programme just brought to realisation by the Santa Fe Company puts in the shade the previous achievements of the Burlington, the Union Pacific, and the Rock Island Lines. It is made effective by a fleet of thirteen specially-built flyers. One is the Super-Chief unit which has been running for some time past between Chicago and Los Angeles once a week in each direction; a second unit now makes possible a twice-weekly all-Pullman service at this speed; and in addition the Chief, which for many years past was the crack train over this route, is now worked with streamlined sets of lightweight cars, of which six are needed to maintain a daily service, but hauled by streamlined 4-6-4 steam locomotives. Not content with this, the Santa Fe management has introduced El Capitan, a twice-weekly high-speed service between Chicago and Los Angeles on the same 39¾-hr. schedule as the Super-Chief, but unique in being composed entirely of "chair-car" instead of Pullman accommodation, at a fare corresponding to third-class in this country. Two of the three further trains will operate on a 7½-hr. schedule each way between Chicago and Kansas City, and will be named the Chicagoan and Kansas Cityan, while the last links Los Angeles with San Diego in 2½ hr., making two return journeys daily. Further details of these developments are given on page 764 of this issue.

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Painting over Rust

It is often the preliminary cleaning of steel structures which adds substantially to the cost of painting. With a view to eliminating this process a well-known British firm of paint manufacturers has recently placed on the market a paint which can be directly applied to rusty surfaces in the same way as paint is normally applied to a perfectly clean surface. This special paint contains a combination of chemical solutions and chlorinated rubber which immediately react with the rust, changing it into a corrosion-proof coating, a film being formed of a dark blue colour which subsequently changes to black. Moreover, the coating thus formed is claimed not only to inhibit the further formation of rust, but also to resist the effects of the weather as well as those of acids and alkalis. Some idea of the protective power of this paint can be gathered from the statement that during the course of investigations single coats were applied to rusty surfaces in unfavourable circumstances and that after four years' exposure they were still undamaged and no trace of corrosion could be detected. There would appear to be considerable possibilities in a paint of this nature, particularly if it can be shown to resist the corrosive effect of locomotive exhausts.

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Cheshire Lines and the Cheshire Cat

Mr. Tom Purvis, the artist of a new poster issued by the Cheshire Lines Committee, has taken some very modest liberties with the boundaries of the county to produce a convincing outline of the Cheshire Cat, whose traditional grin is probably derived from the opinion of the *Manchester Guardian* (printed at the foot of the poster) that the Cheshire Lines is "a railway of undoubted charm." The picture of the cat is ingeniously combined with a clear map of the system, which will assist the public to put into effect the advice of the poster, "Travel Cheshire Lines." The poster has a black background, with county boundaries in blue, the Cheshire Lines system in red, connecting railways in grey, and the "cat" in white. Mr. G. Leedham, Secretary and Manager of the Cheshire Lines Committee, who sends us the poster, informs us that Mr. Purvis has conscientiously studied the accepted authorities on cats (Cheshire) at the British Museum. Our reproduction of the poster on page 744 suggests that he has based his interpretation on evidence supplied by the late Lewis Carroll.

Iraq Railways

THE report of the Iraq Railways administration for the year ended March 31, 1937, is the first annual report to be issued since the transfer of ownership to the Iraq Government under the agreement which came into effect on April 1, 1936. The Director-General, Colonel J. C. Ward, marks the occasion by recapitulating the history of the railways. A full description of the lines and an outline of the events leading up to their transfer by Great Britain to Iraq, was published in THE RAILWAY GAZETTE for May 15, 1936, page 946. Briefly, it will be recalled that in 1914 the only railway in Iraq was the Baghdad—Samarra section of the Haidar Pasha—Basrah project. In the course of the Mesopotamian campaign military operations made necessary a considerable extension of the lines in various directions, some of the track, rolling stock, and personnel being supplied from India. These lines, constructed by the British forces, formed the basis for the present system, which was made over to the civil authorities in 1920, and came under the control of the newly formed Government of Iraq from 1923 until April 1, 1936, when the transfer of the railways to the Iraq Government was finally ratified in consideration of a payment of £400,000. The system at present consists of three main sections, Margil—Baghdad, Baghdad—Kirkuk, and Baghdad—Baiji. The two first-named sections are of metre gauge and the last named is of standard 4 ft. 8½ in. gauge. There are various branches, bringing the whole mileage to 752, of which the standard gauge portion accounts for 132 miles. A through rail and road service, worked by the administration, connects Basrah with Tel Kotchek, whence the Simplon Orient, and Taurus expresses afford communication with western Europe. The construction was inaugurated by the Prime Minister on November 20, 1936, of the extension of the standard gauge line from Baiji to Mosul and thence to Tel Kotchek, the terminus of the Syrian Railways, whereby Iraq will have direct rail communication with the whole of Syria and Turkey in Asia, and the grain of Mosul can be transported into Iraq.

For the year of working under review, the accounts reveal a surplus, allowing for 25,071* dinars appropriated from renewal fund, of dinars 94,376, against a surplus of only 9,788 dinars in the previous year. Receipts showed an appreciable increase under both passengers and goods, and the operating ratio fell from 98·1 to 88·6 per cent. The Director-General points out, however, that the existing system having been built up "out of the debris of the great war," much remains to be done before it can be brought up to the required standard. The principal operating figures compare with those of the previous period as follows:—

	1936–37	1935–36
Length of line open, km.	1,211	1,211
Passengers	2,083,794	2,053,606
Passenger-kilometres	227,446,608	209,467,812
Revenue-earning goods, tons ..	692,790	463,639
Goods, ton-kilometres	271,290,066	168,284,722
Train-kilometres	2,599,410	2,276,871
perating ratio, per cent.	88·57	98·07
	Dinars	Dinars
Coaching receipts	188,351	175,197
Goods receipts	407,554	324,331
Total earnings	606,626	508,888
Working expenditure	527,321	499,100
Appropriation from renewals fund	25,071	—
Net earnings	94,376	9,788

The earned revenue is the highest recorded since 1931, notwithstanding the fact that reduced freight rates were introduced for local produce. Passenger traffic was 1·5 per cent. higher. There was a further increase in the number of passengers travelling by the Simplon—Orient Express rail and road route. During 1936 the service between Baghdad and London was one of six days. The number of passengers found travelling without tickets and dealt with by the travelling examiners was 225,613. Rail-car kilometrage fell from 84,023 to 46,842. The increase in goods was mainly in grain and dates, the tonnage of barley increasing by no less than 94,163 and that of wheat by 109,615 tons. The total of 692,790 does not include 432,066 tons of earth for the reclamation scheme at Baghdad East, undertaken at the request of the Government. Rolling stock at times was insufficient to meet the extra demands of traffic. Road competition continues unabated, but there are signs that the charges by this form of conveyance have reached bed rock. The tenders for the construction of the new Baghdad bridges has been awarded. The wagon ferry worked daily except for 15 days due to floods and general holidays. Considerable damage was caused by floods in the Euphrates river during the year, with some delay to traffic. Ballasting work was partly suspended in favour of the reclamation scheme at Baghdad East. A great deal remains to be done in track and rolling stock repairs and renewals, says the report, and large sums will have to be steadily expended, in order to make the administration an up-to-date organisation capable of meeting the needs of the country as it progresses.

* The Iraq dinar is nominally equivalent to £1.

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The Colombian National Railways

OF the 3,254 km. of railway actually working in the Republic of Colombia, 1,561 km., or 48 per cent. are operated for the State by the National Administrative Railway Council. According to the bulletin issued by the council, the system is worked in six different sections, of which the accounts and statistics for the respective sections are kept separate, as well as those of the 47 km. of aerial cableway between Gamarra and Ocana. The results are now published in the bulletin for the five years 1932-36, and for the first half-year of 1937. The following figures are those of the National system only, and for the year 1936 as compared with 1935:—

	1936	1935
	$	$
Gross earnings	12,379,168	10,730,382
Expenditure	9,236,430	8,379,987
Renewals and betterments ..	1,651,649	1,392,056
Depreciation	500,000	480,676
Insurance	58,789	117,450

After providing for sundry net revenue items and for a special credit to capital account in 1936 of $184,148, the proportions remaining to be credited to the National Government were $737,889 in 1936, against $359,307 in 1935. These figures include the ropeway and pier services. For the first semester of 1937 gross earnings were $6,322,947 and working expenses $4,713,564. The net surplus credited to the National Government, according to Law 204 of 1936, goes to form a fund to be devoted exclusively to works of betterment on the railway system. The approved plan for these betterments includes the following new works: the remainder of the railway to link up the Pacifico and Antioquia lines, requiring about 100 km. of track, of which 38 km. are already in construction; the junction of the Girardot and Pacifico lines, either by a railway estimated to cost some $15,000,000 or by improving the grading and location of the present road connection; the prolongation of the first section of the Central Northern, and of the Nariño lines, and also of

the Girardot-Tolima-Huila Railways. The plan also includes a proposal for a central passenger and goods terminal station at Bagotá, in which the termini of all the railways would be centralised. The Railway Council has also undertaken the co-ordination of road services, and already works or contracts out all the most important bus and lorry services acting as feeders to the railways or as link lines between the termini.

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The Conveyance of Potatoes

THE attractive posters now being displayed at railway stations on behalf of the Potato Marketing Board, to encourage the consumption of potatoes in Great Britain, are a reminder that potatoes, with a yield estimated at about four million tons annually, constitute one of the staple agricultural crops of the country. Potatoes are grown in practically every county in England, Wales, and Scotland, but the land in certain areas in Scotland, Lancashire, Yorkshire, Lincolnshire, and East Anglia is particularly suitable for this purpose, and large quantities of potatoes are produced to meet the requirements of the principal centres of population. A very considerable acreage in Scotland is devoted to the growth of potatoes for seed, and it is estimated that about 150,000 tons of these are despatched every year, principally in the early spring, to destinations throughout Great Britain for the purpose of augmenting supplies of locally grown seed. A substantial proportion of the national potato crop is used for local consumption, and consequently requires conveyance only for comparatively short distances, but there is a constant movement of the traffic by railway from the growing areas to the more distant markets. A heavy tonnage also passes through the various ports in the country, over 200,000 tons of the early varieties being imported and just over 55,000 tons exported during 1937.

Potatoes are carried by railway for an average distance of 120/150 miles, and during 1936 nearly one million tons were carried in lots of 4 tons and upwards, at station to station rates, at a charge which averaged nearly twelve pounds for one penny. With the producing areas scattered throughout the country, it is not surprising to find that the volume and movement of the traffic varies according to the season of the year. The trade in home-grown early potatoes begins in June, and until July the flow is to the east and north. The next earliest variety is usually available during August, and for the rest of the season the flow is from the eastern counties to the south and north. The quantity passing through the ordinary trade channels is comparatively small in the late autumn when local supplies are available, but from October to May a heavy tonnage is constantly passing to the markets. In connection with the marketing of these supplies the British railways frequently make comprehensive transport arrangements embracing the collection, loading, sorting, conveyance, and delivery of the traffic. As potatoes are very susceptible to damage by frost or overheating, special care is taken to minimise the risk of damage from these causes.

The initial step in the conveyance of the traffic to the consumers is often provided by the railway companies' country lorry services, which operate from 2,750 country stations or central depots throughout Great Britain. These services work to regular schedules, which often embrace calls at outlying farms situated from ten to twenty miles from the railhead. The services, which are also available for the road conveyance of agricultural supplies and produce generally, are operated to a timetable which enables the traffic to be despatched on express freight trains and to reach the markets at the majority of centres very early on the morning after despatch. Where desired, the railways undertake the throughout conveyance by road motor for short distances of potatoes destined for local markets or consuming areas. Extensive facilities are also provided at many railway stations for the storage of bulk supplies of potatoes, and, if desired, the companies will also undertake the delivery from stock to customers and the maintenance of the necessary stock, cash, and other records. The establishment of potato markets at some of the larger railway depots has considerably facilitated the work of the merchants, and a heavy tonnage passes through them annually. It is also of interest that the railway companies use about 1,100 tons of potatoes annually on their restaurant cars, as well as a substantial tonnage in the 54 hotels which they own and work.

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French Railway Economies

M. PIERRE GUINAND, President of the National Railways Company, who is engaged in the arduous task of reducing expenditures and increasing the traffic receipts of the now unified system under him, has won distinction both as an engineer and as a financial administrator. He carried out the construction of the famous Maginot line of defence on the eastern frontier of France, and for many years supervised the expenditure of the vast sums allocated to the Ministry of War for national defence. He was afterwards head of the *Cour des Comptes* which controls the Governmental and municipal accounts of the whole of France. In a recent interview, given to *Le Matin*, M. Guinand said that the essential purpose of his new post was to aim at balancing the railway budget. Economies in organisation came first. These included the abolition of a number of posts held by administrators and high officials; the reduction of certain financial and technical services; and the pooling of all equipment and of its construction and repairs. Next came economies in management, including the standardisation of operating methods on all the lines; a central agency for purchasing all material, and the closing of numerous unprofitable lines. M. Guinand cited the case of one line in the South-East region, which cost fr. 2,000,000 annually to operate and brought in only fr. 200,000 in receipts.

Railway receipts, said M. Guinand, could be increased by co-ordination with road, water, and air transport in a way that would eliminate ruinous competition. But he held that the best means of increasing receipts was by giving greater facilities for both passenger and goods traffic. Increased facilities had been provided this season for winter sports by running more trains and by lowering fares. The Sunday traffic from Paris and other large cities to country districts would be still further encouraged, and means of promoting Sunday traffic from the country to the towns were also being studied, as was the question of providing greater facilities for sending country produce to the towns. The problem of balancing the railway budget depended upon an improvement in trade, but the efforts now being made to promote traffic would tend to reduce the current deficit.

The Ministry of Public Works has recently reported substantial progress with the plans for the co-ordination of rail and road traffic. It appears that 25 departments in all parts of France have already approved their transport plans, and that five other departments will accept the plans in the April sessions of the general councils. The decisions of these 30 departments mean that two-thirds of the programme for closing lines to passenger traffic in 1938 may already be considered as assured. The resulting economies will be far in excess of the estimated fr. 180,000,000. M. Jules Moch, Minister of Public Works

in the new Cabinet, has sent a message through M. Guinand to the 500,000 railwaymen of the National Company, reminding them that the railway deficit is one of the budget's financial burdens, and that to reduce it in any measure is to contribute to the defence of the country and its freedom, at a time when expenditure for national defence is imperative. The Minister adds that the railwaymen can play an important part in this matter, and should seize any opportunity to suggest possible economies they may note in the course of their work. He urges them to aid in preventing any waste of time or money.

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Apis Transatlantica (Railway Variety)

WHILST we have become accustomed to flights across the Atlantic, it is only recently that bees have droned their way over the ocean. The spelling bee, almost unknown here a few months back, is now a familiar and much appreciated variety, but how long will it be before the corn-husking bee becomes an equally popular species? Yet corn-husking bees are welcomed in Connecticut, and although corn in Connecticut means maize to the Englishman, it is not beyond the capacity of the latter to find an indigenous substitute to take the leading role in a corn-husking bee. Attention was recently called to this autumn ceremony when New Yorkers were invited by one of the railways to partake of a corn-husking bee excursion into the deep country; many accepted the invitation and were initiated into the mysteries thereof. The competition consisted of splitting into pairs and husking the corn; he who was so lucky as to find a red ear of corn, by the laws of the game, is allowed to present his partner with a kiss. So excellent a game was soon played quite expertly by the city-born New Yorker and it was reported that the Connecticut countrymen marvelled at the industry of the metropolitan dweller in his search for red ears, indeed they marvelled at the number of red ears which it is claimed were found.

So jealous was another railway that, not to be outdone, it discovered another species of bee and in due course announced its discovery in Baltimore and Washington. The venue of this " Autumn Leaf " bee was at Oakland, two hundred and fifty miles away, and the marching orders consisted in rising early, equipping oneself with a camera and travelling to Oakland, where the town band and nearly one hundred private cars had been assembled in spite of the rain. Members of the invading forces from Baltimore were duly loaded into the cars and driven through the surrounding country by the hosts of Oakland, who acted as chauffeurs, with the Mayor as Commander-in-Chief of the cavalcade. Box cameras, miniature cameras, cine cameras, large lenses and small lenses were all brought into action as the beautiful vistas of autumn leaves came into view. Pines were shot at, oaks, hemlocks, and chestnuts were shot at, but Deep Creek Lake was the final objective and was attained only in the late afternoon. Thus was born the camera bee, and it requires development. Many English resorts must be jealous of Oakland, but will they give the camera bee such a warm welcome with mayoral hospitality when it wings its way across the Atlantic? Perhaps not, but the countryside should certainly import the corn-husking bee in order to introduce the Londoner to simple country sports and make him realise the necessity of preserving rural England.

LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

Railway Speed Records

London, March 21

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—By experience it would seem a common happening that the speed records achieved by the railways should grow in magnitude with the passage of time. The legendary achievements of the past, such as the broad-gauge run of long ago over the 53 miles from Paddington to Didcot in 47 minutes, will be recalled by many; but the process of expansion with time still appears to continue. The latest example is the run made by the L.M.S.R. Coronation Scot from Euston to Crewe and back on June 29 last, in the week prior to the entry of that express into daily service. We now understand from the speech made by Sir Josiah Stamp, President of the Executive, to the shareholders of his company at the recent meeting, fully reported in your March 18 issue, that in the descent from Whitmore to Crewe 5 miles were covered at an average speed of 108 m.p.h., and 2 miles at 112½ m.p.h., with a momentary maximum of 114 m.p.h. In THE RAILWAY GAZETTE of July 2, 1937, a detailed timing of this run was given, in which the speed of 112½ m.p.h. was indicated for *one* mile, not two; and in your monthly contemporary, *The Railway Magazine*, a considerably more detailed record appeared in the August, 1937, issue, showing the times to one-fifth parts of a second over each half-mile from Whitmore until steam was shut off and the brakes applied for Crewe, which clearly indicates the precise two half-miles over which the 112½ m.p.h. speed was sustained, and also an average speed for the 5 miles which were covered at the highest speed, not of 108 but of 107·1 m.p.h. To adjust these figures in such a way as to admit 2 miles at 112½ m.p.h. would put the entire timing out of count; either these figures are wrong, or the two miles at 112½ m.p.h. cannot be maintained. The only authority for the 114 m.p.h. maximum was not the stop-watch readings, but the self-recording engine-speed indicator.

These differences may seem of minor importance. So they would be were not such constant use made of the figures subsequently for propaganda purposes, and still more so when the speeds are subsequently modified in such a way as to become even more spectacular. It can only be assumed that the figures quoted by Sir Josiah Stamp were those taken from the self-recording indicator of the locomotive, but it is doubtful if the accuracy of these contrivances can be guaranteed within less than 2 or 3 per cent. of the figure actually recorded. When the French maximum speed limit stood universally at 120 km.p.h., drivers on the Nord and Paris—Orleans Railways were always allowed a " tolerance " of 5 km. and on the Est of 3 km. above the legal limit for this reason. In no other transport realm in which there is competition for records would they be allowed to rest on such evidence alone; one may contrast it, for example, with the elaborate electrical timing appliances that are used in connection with speed trials of racing cars or of aeroplanes. If these railway speed achievements are thus to be made the subject of competitive publicity, one can only suggest that the railways should between them appoint a panel of experienced and impartial observers, two or three in number, to accompany these test runs, and after their conclusion to present agreed figures on which reliance can be placed, and which should be regarded as final.

Yours faithfully,

CRITICOS

[See editorial comment on this letter on page 738]

PUBLICATIONS RECEIVED

The **Formation of the New England Railroad Systems : A Study of Railroad Combination in the Nineteenth Century.** By George Pierce Baker. Cambridge, Massachusetts : Harvard University Press. London : Humphrey Milford, Oxford University Press, Amen House, Warwick Square. 9 in. × 6 in. 283 pp. ; illustrated with maps. Price $3.50 or 15s. net.—Railway history and railway configuration have varied perhaps as greatly within the one nation of the United States as within the many nations which form and have formed the political Continent of Europe. Obviously, this is due largely to the physical differences of the various districts of North America, yet one needs to know one's America only a little to realise how greatly the various states differ from one another on the human side. In spite of one universal language, there is perhaps nearly as much difference between, for example, Vermont and Louisiana, as there is between Scotland and Italy. The states forming New England are, and were even more in the past, the real land of the Yankee, so the volume under review takes on the guise of a national history.

New England today is, for the most part, served by two railway systems only, that of the Boston & Maine Railroad in the north, and that of the New York, New Haven & Hartford in the south. There is yet the Central Vermont line, worked curiously enough by a foreign administration, namely, the Canadian National Railways. But the time was when the transport needs of New England were served by a large number of independent, and more or less warring, interests, and it is with these, and with their gradual merging into either the Boston & Maine or the New Haven, that the present work deals.

Mr. Baker opens his survey with a comprehensive introduction, an important chapter in itself, dealing with the geography of New England, and with the social and economic structure of its component states during the last century, on which its railway transportation services were progressively built up. This introduction is illustrated by an excellent map of the railway system of the six states towards the close of the nineteenth century, serving as a key map for the plans of individual railways in the succeeding chapters. Thereafter a chapter is devoted to each of the old main-line railways in turn, beginning with the Boston & Albany, which eventually, unlike most of the others, came under New York Central control, though joint control by the N.Y.C. and the New Haven prevailed for a short while. This history, as its sub-title suggests, is concerned exclusively with the formation and gradual fusion of the different systems, and not with studies in working or modern developments. The result is an extraordinarily complete reference book on the " lineage " of the present railways serving New England. A most useful feature, for ready reference purposes, is the summary with which every chapter concludes, wherein the history of the line is rapidly recapitulated within a single pithy paragraph.

This is a sober book, and the author deals in a coldly detached way with the deadly rivalries and sometimes peculiar business methods which prevailed among the railway companies of Old America. For the serious railway student, interested particularly in the economic history of New England railway transport, it should prove a valuable work. For the more general reader, it forms a solid background against which racier, but hitherto less well-documented, accounts stand out the more clearly. In its special sphere it fills a previously unoccupied gap, for as far as we know the railways of New England have not, up to now, been dealt with really fully and at length in any book. The final chapter forms a conclusion in which the merging of the several lines in the latter years of the nineteenth century is fully summarised. The book closes with a bibliographical note, and is fully indexed.

Städtebau ; Handbibliothek für Bauingenieure (Town-Planning : A Treatise for Engineers). Second Edition. By O. Blum. Berlin, W.9 : Julius Springer, Linkstrasse 22-24. 10 in. × 6⅝ in. 244 pp. Price Rm. 22·50 net.—In writing this book on town planning, Dr. Blum's avowed object was to produce, not a detailed treatise on the technology of town building, but a broad and balanced conspectus of the subject, suitable for collateral study by men training for all those professions, from architecture to electric traction, which contribute to the making or marring of towns. He shows the mark of the man of learning by the analytical way in which he discusses the component parts of a town and their effect upon the whole ; yet one often recognises behind his words the mind of the practical transport man. What sound, practical comment he gives may be gathered from this fragment of his section on railway station plazas : " Out of the station buildings stream great masses of arriving passengers, many of them strange to the town, hurried, nervous, and lacking in ' traffic-sense.' This stream must not immediately cross a carriageway, lest both pedestrians and vehicles be endangered ; outside the main exits one must provide large peninsulas of footway, upon which the stream can calm itself and the strangers can get their bearings. . . . Here should be provided plans of the city and environs, timetables, inquiry kiosks, underground conveniences, &c. (but no grass verges or statues !) . . ."

Railways and railway stations are unquestionably among the most patent instruments in moulding the form of a town. It is the custom of writers of British text-books on town-planning either to ignore this fact or to refer to it very briefly and in terms of hostility. Dr. Blum is, however, a recognised authority not only upon town-planning, but also upon the design and operation of railway stations and yards, and he devotes a considerable portion of his book to the needs of the railway system and the ways in which they can be met without injury to the harmonious development of towns. He argues, forcefully but without one-sidedness, that the accommodation of long-distance rail transport must be one of the first calls upon the land when the town site is being apportioned. Perhaps conventional town-planners may be aghast at his suggestion that reservation of the sites of the marshalling yards should be the first step in the formulation of a traffic plan, but railwaymen will appreciate the wisdom of his point.

Sixteen well-illustrated pages are devoted to urban rapid-transit railways, and eight more to the suburban lines of main-line railways. One might comment adversely upon his determination to give separate treatment to these two types of line ; for his part, he does not spare the L.P.T.B. for its action in combining the statistics of both types. It must suffice to say that the subject is a debatable one, and that Dr. Blum does not appear to have weighed the pros and cons as carefully as in other parts of his book. With regard to the location of rapid-transit lines, it is interesting to note that he favours an L-shaped route, somewhat like that of the Piccadilly Line, because it can be made to give direct interchange facilities.

Cook's " Handbook for the British Isles."—The appearance of the 1938 edition of this attractive brochure serves as a reminder that Cook's organisation is not devoted exclusively to " smoothing the path " of those intending to travel on the Continent or overseas. A wide range of suggested holidays at home is set forth in this booklet, but holidaymakers are not limited to the inviting tours that have been prepared, as variations may be made to suit individual tastes.

Special Grade Wrought Iron.—The preparation of British Standard Specifications for lifting chains and fittings introduced with it the question of the quality of material to be used, and B.S.S. No. 762—1938, for Special Grade Wrought Iron, has been prepared and can now be used as providing the type of material suitable. Copies can be obtained from the British Standards Institution, 28, Victoria Street, S.W.1, price 2s. 2d. post free.

Materials and their Testing.—The Joint Committee on Materials and Their Testing held its first general discussion at Manchester in October last. All the papers on Notched Bar Impact Testing then presented, with the report of the discussion and communications, are now available as excerpts from the Transactions of the Manchester Association of Engineers (St. John Street Chambers, Deansgate, Manchester, 3s. 6d.).

THE SCRAP HEAP

I suppose that at a very early age most healthy boys want to be an engine driver. It is at a later and less healthy age that they want to design them.—*Dr. Leslie Burgin, Minister of Transport, at the Institution of Locomotive Engineers annual dinner.*

* * *

C.P.R. BELL FOR L.N.E.R. LOCOMOTIVE

The Canadian Pacific Railway has presented to the L.N.E.R. a locomotive bell of the standard type used in Canada, for the streamlined Pacific locomotive No. 4489 *Dominion of Canada* which has always been fitted with a whistle of the Canadian type now standard on L.N.E.R. streamlined Pacifics. This whistle was also presented by the C.P.R., and its distinctive note has by this time become well known on the East Coast Route between London and Scotland. The bell has been mounted in front of the chimney of No. 4489 and will be an object of interest to passengers, especially travellers from Canada, during the coming season when this locomotive will be seen on many trains conveying visitors to Scotland for the Empire Exhibition.

* * *

PUNCH'S RAILWAY

For many years the West London Railway remained, as it does still remain, a valueless property. *Punch*, with more wit than good nature, thereupon claimed the railway as his own, and the West London has ever since been facetiously called Punch's Railway. It is a half-finished concern, and therefore it is no wonder that it is valueless. But what is the value in use of a half-finished house? And how many of the best houses in and round London were for years like Punch's Railway? Let us not estimate the real and future value of this line by its past and present condition. It is situated to be highly valuable, and valuable it will be, provided it be completed as it naturally should be, a matter now of great probability.—*From "Herapath's Railway Journal" of December 4, 1858.*

* * *

A BUDDING JOURNALIST

The *Great Western Railway Magazine* for March prints as a curiosity the following letter, written by a small boy on his first visit to London to impress upon his still younger brother in Bridgnorth the marvels of the Metropolis:—

"The sight of Paddington station is really beyond description. The roof is practically invisible being 2,500 ft. above the platforms, aeroplanes circling beneath it all day. The roof is made of glass and requires 5,000 men to clean it once weekly in an airship. There are so many platforms that it is totally impossible to count them—the length of them is quite five miles. There are motorbuses to take passengers from one end of a platform to the other; each bus holds 3,000 people. The trains are colossal; each train consists of 4,000 coaches and requires 20 engines to pull it. The trains are of the corridor type and are equipped with motor cycles to convey passengers to lavatories and dining saloons. Each engine is 50,000 h.p. and requires 50 men to stoke it. It is necessary to have motor lorries in each cabin to convey the coal from tender to firebox. There is a refreshment room at Paddington station which is seven times the length of Bridgnorth High Street and four times as wide. The stationmaster is as big as St. Leonard's Church, Bridgnorth, the biggest man in the world. One cannot fail to hear him coming, as his boots are as big as the North Gate. He walks over the trains without any difficulty whatsoever."

* * *

THE ORIGIN OF STEAM HEATING ON TRAINS

The following Letter to the Editor, which appeared in *The Railway Times* of January 23, 1841, is not without historical significance:—

"Sir,—Having been during the last two months a frequent traveller by railway, my attention has been drawn, by the intense cold we have so lately experienced, to a method of keeping the carriages warm, as it is in the feet that the cold is so severely felt. My plan is to receive all the waste steam from the locomotive engine into a pipe constructed for the purpose, and so conduct it through the flooring of all the carriages; and by leaving the end of the pipe under the last carriage in the train, open, the condensed steam would thus be enabled to run off, after having distributed its warmth to the different carriages composing the train. The pipes would, of course, be provided with sliding tubes to allow for the play between the carriages, and also to allow of their being detached from the train, without unscrewing any part of the pipe. I think something of this kind might easily be constructed, and it would (in the winter months, certainly) conduce greatly to the comforts of railway travelling.

"I am, sir, yours respectfully,
"G. W.

"London, January 11, 1841."

* * *

SCROUNGING THE SCRAP

Half a mile of railway line, a historic cannon, and a large monument from the local cemetery, are among thefts reported at Haverstraw (New York). The authorities believe that the thieves have been tempted by the high prices now given for scrap iron.

* * *

These days of rapid transit recall the case of the American who strolled into Grantham as the Scotch Express flashed by and, going up to a porter standing on the platform, said to him, "I suppose you call that an express?" "No," said the porter, "that's only George doing a bit of shunting. He'll come back in a minute."—*Dr. Leslie Burgin, Minister of Transport, at the Institution of Locomotive Engineers annual dinner.*

The Cheshire cat as seen in the boundaries of its native county by Mr. Tom Purvis, whose poster for the Cheshire Lines Committee is further referred to on page 739

OVERSEAS RAILWAY AFFAIRS

(From our special correspondents)

UNITED STATES

Reactions to I.C.C. Rates Decision

[The keen disappointment of the railroads at the recent I.C.C. tariffs decision, and the inadequacy of the increase in rates as compared with their demands, were briefly reported in the news section of THE RAILWAY GAZETTE of March 18. Also in the same section of the issue of March 25 we outlined the principal rate increases now sanctioned.—ED. *R.G.*] Besides agricultural products, wood for building purposes comes into the 5 per cent. increase category, and the enhanced rate for anthracite is 5d. a 2,000-lb. ton. No additional rate has been allowed on coke or bituminous coal. So far the commission has given no decision in response to the request of the Eastern railways to raise coach passenger fares from 1d. to 1¼d. a mile.

The railways, the financial community, and many political leaders are stunned by the decision to allow only so insignificant an increase in freight rates, the average extent of which, with bituminous coal, coke and iron ore excluded entirely, will average barely more than 5 per cent. The commission itself in permitting some small rate increases last November expressed its conviction that railway earnings were far from adequate, and that rates at a genuinely compensatory level could not be indefinitely postponed. The President clearly indicated his belief that a substantial rise in rates was justified. Even the trading community—usually at one in opposing rate increases—was in this instance strongly favourable to a substantial increase in rates. Most observers had expected that the commission, if it did not accord all the railways asked, would at least grant them an all-round average 10 per cent. augmentation, and even the most pessimistic did not predict less than half what the railways had asked.

Logic of I.C.C. Position

Although the commission did not state the grounds for its decision—beyond the undesirability, from the standpoint of justice to traders, of increases larger than those granted, and the likelihood that too great increases would lead to diversion of traffic to rival agencies of transport—clearly it had in mind the belief that railway difficulties should be solved, in part at least, by reduced expenses, rather than entirely at the expense of the trading community. Expenses cannot be reduced materially without immediate injury to some interests, with political-railway labour prominent among them. Railway hourly wage rates are averaging from 15 to 30 per cent. higher today than they were at the bottom of the depression in 1932, increases in no wise justified either by rises in the cost of living or the ability of the industry to pay. These rates were increased last summer and autumn when railway traffics were already drastically declining.

Legal Rights of Unions

But the machinery of negotiation for changes in wage rates is cumbersome and slow, unless the union chiefs happen to waive their legal rights. And whether they will do so or not depends in large measure upon whether they really desire private ownership of the railways to continue. If they put up a stiff resistance to wage reductions, and secure the support of political authority in their stand, it is obvious that before long some essential railway services must be discontinued, unless aid is received from the public treasury.

Wholesale amalgamations might improve the railway outlook, as well as a general reduction in wages, but it is not clear that such a solution would be any more acceptable to the labour chieftains than would wage reductions, and this solution would be even less favoured by powerful sections of the trading community than would wage reductions.

Conference Called by President

An informal conference of three Interstate Commerce Commissioners (Messrs. Mahaffie, Eastman, and Splawn), the Chairman of the Reconstruction Finance Corporation (Mr. Jesse Jones), Mr. Carl Gray (retired President of the Union Pacific Railroad), the Chairmen of the commerce committees of the two branches of Congress (Senator Wheeler and Congressman Lea), and several other Government officials, has been nominated by President Roosevelt to canvass and report on possible solutions to the railway crisis. But at the time of writing it is not believed that any one has an "answer" which is politically feasible. [As noted in the news columns of our issue of April 1, the President has appointed a small subcommittee to report to this conference. —ED. *R.G.*]

EIRE

Excursion Innovation

The Great Southern Railways arranged an excursion on St. Patrick's day, a public and church holiday, from Dublin to Mullingar, Athlone, and Galway. The usual difficulty to be overcome with the early start of excursions in Eire on church holidays or Sundays is that travellers require to attend religious ceremonies before travelling, and a start as early as 9.0 a.m. precludes many from travelling. On this excursion, however, the train stayed at both Mullingar and Athlone on the outward journey for an hour, and the passengers were thus enabled to attend the ceremony at Mullingar or ramble round the town and see the new cathedral. An hour also was allowed at Athlone for similar purposes. Some of the passengers took advantage of this excursion to travel to a football match at Athlone for which there was no other service.

NORTHERN IRELAND

Inquiry into Working of Transport Act

Important decisions affecting the official inquiry into the Rail and Road Transport Act were announced by Lord Craigavon, the Prime Minister, in the Northern House of Commons, when a motion by nine members to have one inquiry instead of two was adjourned for a week. Contrary to expectation, the commission of inquiry headed by Sir William McLintock, which was first announced to deal with the technical and financial matters, is to be preceded by the Home Office inquiry.

The Private Inquiry

Lord Craigavon told the House that Sir William McLintock's inquiry was to be private, and "as the members are doing this in order to oblige us," they could not be expected to conduct a public inquiry. Lord Craigavon went on: "We could not possibly ask men of their importance and eminence, such busy men as they are, to sit through months of evidence, taking in all the matters which they can check up afterwards when the first public inquiry is held. It would be quite unfair to them to do otherwise."

Terms of Reference for the Official Public Inquiry

The terms of the public inquiry ordered by the Home Office are "to consider representations from the public or other interests desirous of being heard in regard to existing transport facilities or charges." So far no chairman has been chosen. "We hope," Lord Craigavon said, "to get an able and prominent man to act as Chairman of that committee, which will hold its inquiry first." Everybody would have an opportunity of coming before it in order to present his views.

Lord Craigavon denied that Sir Josiah Stamp, the President and Chairman of the L.M.S.R., had called to see him in London to persuade him that the inquiry conducted by Sir William McLintock ought to be in private.

Two speeches were made in support of the motion for one inquiry. Mr. Fred Thompson, the mover, said: "We (meaning M.P.'s) are prepared for a shock, and I believe the public are prepared for a shock." He advised the Government to drop the second or Home Office inquiry.

Mr. Rowley Eliott said: "I look upon inquiry number two as nothing more or less than a smokescreen to lull and blind the public to the real state of affairs. I demand, as a taxpayer, that this inquiry ought to be held in

public, and it is not necessary to hold the second."

INDIA

Cochin Harbour

The fourth stage of the Cochin harbour development works is now approaching completion. Cochin will then rank as one of the most important modern ports on the Europe-Australia route. The Governments of Cochin, Travancore, and Madras, and the administration of Cochin Port, have long been considering ways and means to augment the overseas trade of Cochin. The conversion of the metre gauge railway between Ernakulam and Shoranur to broad gauge —[described and illustrated in our issue of September 6, 1935—ED. *R.G.*] during the early stages of the progress of the harbour works removed an important disability in transport, and traffic from the interior can now be brought alongside the steamers in the harbour without break of gauge. Proposals have also been mooted for the provision of transport facilities to attract to Cochin at a minimum cost in transport charges the products of the rich Anamalai plantations. A railway from Trichur to Kollengode has been suggested, though the proposals for an all-weather motor road between Trichur and Pollachi is not without influential sponsors. Negotiations have also been opened with the Mysore Durbar to consider the construction of a railway linking Mysore State with Cochin. On the early provision of these transport facilities depends the development of the trade of Cochin.

Railways and Commerce

At the forthcoming annual meeting of the Federation of Indian Chambers of Commerce and Industry to be held at Delhi on April 1, railways will come in for their share of criticism. A protest has been tabled for discussion against the tendency to enhance freight rates without regard to commodity price-levels. The adoption of a comprehensive rates policy which will stimulate internal trade is suggested, and railway administrations will, doubtless, be glad to receive any constructive proposals to achieve this end; the discussion on this resolution will be keenly followed by railway rates officers. It is also understood that a resolution on the road-rail controversy will be moved voicing the opinion of the Federation that any scheme of co-ordination should be such as not to restrict or hamper the legitimate growth of motor transport or deprive trade and industry of the most economical means of transport.

Fortified Portal Towers of Khojak Tunnel to be Demolished

The massive portal towers of the famous Khojak tunnel—the longest in India—though they are used as blockhouses, complete with two tramway-mounted nine-pounder guns at each portal, and housing garrisons, are to be demolished, as they are situated within the earthquake danger zone in Baluchistan. The tunnel, which is 2½ miles in length, is near the Afghan frontier, where the strategic branch of the North Western Railway terminates at Chaman. This is the nearest railhead to Kandahar, and there is a lively though seasonal fruit traffic through it.

The tunnel was begun in 1888 and completed, after overcoming many great difficulties, in 1891. Six headings were driven, the two vertical shafts, 318 ft. and 281 ft. deep, being equipped with up and down pairs of cages and winding engines similar to those used in mines. As skilled tunnelling labour was then almost unknown in India, 60 European miners, mostly Welsh, were imported. Underground reservoirs of water, causing great hydraulic pressures, were among the obstacles encountered, states the *I.S.R. Magazine*.

BURMA

Burma Railways' Financial Position

In an article published in the last Overseas Number of THE RAILWAY GAZETTE a hope was expressed that, in view of reduced interest charges and general trade revival, a balanced budget might be achieved by the railway administration for the financial year ending March 31, 1938, but as the approximate traffic earnings up to the end of January show a decrease of Rs. 7½ lakhs in comparison with the previous year, it is now extremely unlikely that the hope will be realised.

The prosperity of Burma depends principally upon its oil, timber, and rice exports, but of these three main commodities it is only the fluctuations in the last which have any appreciable effect on railway earnings. Crude oil is piped to the refineries in Rangoon, and the railway is concerned with only a part of the distribution for internal consumption, from which the earnings are a mere 2 per cent. of total railway earnings; some export timber is railed and is responsible for about 4 per cent. of gross railway earnings, but most of the timber exported is rafted to the ports; rice and rice products, however, normally account for some 25 to 30 per cent. of gross railway earnings, and the railway as a rule carries about the same percentage of the total exports to the ports. Furthermore, fluctuations in oil and timber exports do not affect the large majority of the inhabitants of the country, but the amount and quality of the rice crop, and still more the prices prevailing on the Rangoon market, materially affect the spending power of the great mass of the people, and, consequently, low rice prices are reflected in reduced passenger earnings as well as in lower goods receipts.

The reduced gross earnings have therefore, been caused mainly by adverse conditions affecting the rice trade. In a normal year the crop is harvested in December and January, and begins to move shortly after Christmas, but no appreciable movement occurred this year until the last few days of January. This late movement has been caused partly by two spells of untimely rain during the first and last few days of December, when harvesting operations were in progress, and partly by a lack of buyers on the Rangoon market, which is evidenced by the fact that prices were approximately 10 per cent. lower than last year during January. Again, this unexpected and unseasonable rain has damaged the crop to an extent estimated as a 7 per cent. loss in quantity, thereby reducing the estimated exportable surplus to 3,200,000 tons, a figure 300,000 tons lower than last year. To sum up, it may be said that the crop is smaller in quantity, poorer in quality, and later to move this year than last; and as, in addition, low prices are prevailing, it is almost certain that gross railway earnings will be less this year than last, also the hope of a balanced budget must be definitely abandoned for the current financial year.

CEYLON

Reorganisation Measures Approved by State Council

All the recommendations of the Executive Committee of Communications and Works for the reorganisation of the Ceylon Government Railway have been passed by the State Council, except the one relating to overtime, which has been referred back for reconsideration. A few members criticised the recommendations, arguing that the Government had spent Rs. 1 lakh on the Hammond Commission, but the recommendations of that commission were not being acted upon. There was no proposal to adopt any of its vital recommendations, but, instead, they proposed to retrench about 1,800 men.

Mr. J. L. Kotalawala, Minister of Communications and Works, said that the main point in the recommendations was that they were proposing to save more than Rs. 1,000,000, and the intention was not to cause hardship to guards and drivers, but to prevent wasteful overtime pay.

The following are the recommendations adopted :—

1. *Cadre.*—That the cadre of all sections of the railway be reduced to the present requirements, subject to the provisions that, (*a*) no employees below the retiring age limit—other than certain firemen—should be compulsorily retired, unless they are physically incapable of carrying out their duties efficiently; (*b*) the railway should continue to carry redundant personnel, including daily-paid labourers, until they can be absorbed by other Government Departments.

2. *Recruitment and Training.*—That suitable young Ceylonese with honours degrees should be recruited early as probationers for posts of Assistant Transportation Superintendents and sent to England for training.

3. *Organisation.*—That the existing organisation of the railway be altered by, (*a*) reducing the number of districts in the Way and Works Department; (*b*) gradually abolishing the grade of Inspector of Permanent Way; (*c*) lengthening platelaying sections; (*d*) reducing the number of men employed for maintenance per mile

of track, and (*e*) by the introduction of pooling and double-crewing of engines on an extended scale.

4. *Maintenance.*—That the maintenance of railway buildings should be carried out on contract wherever possible.

5. *Centralisation of Workshops and Stores.*—That all major mechanical engineering work of the railway be centralised at Ratmalana, all other workshops being, as far as possible, either closed down or so reduced as to permit only of minor repairs being undertaken in them; and that all way and works stores in Colombo and at outstations be abolished, these storekeeping services being undertaken by the Railway Storekeeper.

6. *Equipment.*—(*a*) That the railway should be divided into first and second class lines for the purpose of track maintenance and two grades of sleeper introduced, the second grade being used generally on second class lines. (*b*) That improvement of the track with a view to higher speeds be undertaken only on such sections, where the density of passenger traffic justifies it. (*c*) That the running of "baby trains" be curtailed and railcars be ordered to replace them.

7. *Sunday Pay.*—That Sunday pay on the railway should be paid in accordance with the following principles: Sunday pay for train crews, shed staff, and goods shed staff in the Transportation Department, and for all supervisory grades and labour in the Way and Works and Mechanical Engineer's Departments should be at the rate of time-and-a-quarter for the actual number of hours worked, provided that in every case when a man is required to work on a Sunday, he should be paid for at least one hour.

HOLLAND

New Summer Timetables

The Netherlands Railways are very busy in all departments preparing for the new summer train services; a rigid timetable will be introduced on all lines. The present service at half-hourly intervals, with additional intermediate trains during peak traffic hours, will be maintained on the Amsterdam—The Hague—Rotterdam—Dordrecht electrified main line, and on the suburban lines from Amsterdam. The Hague, and Rotterdam, Trains will run at hourly intervals on the newly electrified sections radiating from Utrecht to Amsterdam, The Hague, Rotterdam, Eindhoven, and Arnheim, and on connecting steam-operated lines in the central area. Longer intervals will be introduced on provincial lines, but all departures will be spaced regularly. The maximum speed for trains on the newly electrified sections will be increased to 75 m.p.h. The diesel trains withdrawn from the now electrified lines will be used for the fast services to the outlying provincial capitals, which will be brought, in some cases as much as a full hour, nearer to the chief towns.

New paths have had to be found for the international trains, which will not be allowed to upset the rigid timetable for the internal services. In some cases this will mean speeding up of these express services, but in others the solution has been found in earlier departures or later arrivals in Holland.

The new electric trains are now running to the timings of some of the diesel trains for staff training and for the purpose of running in the new stock, to ensure a smooth transition to the new timetables on May 15.

ITALY

Railway Developments Reported to Parliament

Sgr. Stefano Benni, Minister for Communications, in reporting the activities of his department during 1937 to the Italian Parliament, pointed out that the 1936-37 financial account of the State Railways administration, for which he anticipated a profit of 150 million lire, had been closed with a profit of 178 million lire. The 1937-38 account, in spite of the increased expenditure, is likely to show correspondingly favourable results. From July, 1937, to February, 1938, the volume of passenger traffic has shown an increase of 12 per cent. and goods traffic an increase of 23 per cent., and the receipts for these traffics have risen by 20 per cent. as compared with the figures for the corresponding period of the 1936-37 fiscal year.

Referring to the works carried out by the State Railways administration, the Minister instanced the construction of the new Rome Central station, which is to be inaugurated on the arrival of Herr Hitler, and the doubling of the Arona—Domodossola section in order to raise the capacity of the Simplon route. In connection with operating economy, he pointed out that the consumption of coal per unit of work done by the steam locomotives had been reduced to kg. 50·9 during 1936-37, against kg. 51·9 in 1935-36, and kg. 53·7 in 1934-35.

SCANDINAVIA

Swedish Royal Coaches

The private coach of King Gustav V of Sweden was built in 1931 to replace an earlier vehicle that had become too shabby for further royal use. Of all-steel construction, it was built in the Kockums engineering works of Malmö, Sweden, is 77 ft. long, weighs 54½ tons, and is, of course, of standard gauge, thus being suited to take its royal occupant almost all over Europe. Quarters for His Majesty include a comfortable lounge compartment, with the usual tables, desk, and easy chairs; and a simply furnished bedroom, with its own lavatory, toilet, wardrobe, &c. The only decoration in the King's lounge and bedroom is a plain border of inlaid wood. Besides His Majesty's suite, the coach has five staterooms for his personal servants, as well as aides, adjutants, secretary, and other staff. There is also a small pantry for the preparation of light refreshments, but no dining saloon. When Gustav V uses the car in Sweden, a dining car is attached. When he goes abroad in his coach, he patronises the public dining car of the train.

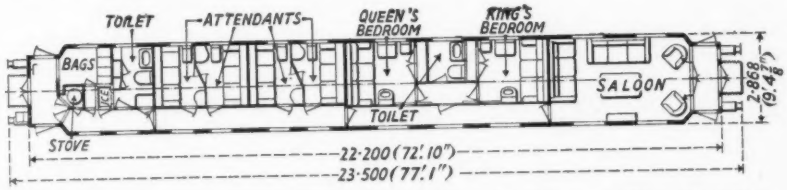
Three Systems of Heating

A special feature of this coach is that three kinds of heating are provided steam, electric, and hot water, to adapt it to the system in use on the different trains to which it may be attached. A boiler at one end can be fired by coal if the electrical system of the train is not of the voltage for which the King's coach is wired. At the opposite end of the car is a fairly large baggage room for the King's trunks and tennis paraphernalia. The cost of the car was £9,000.

The Crown Prince of Sweden does not use his father's coach. When he and the English-born Crown Princess Louise go travelling, they use a coach which was built in 1908 for the late Queen Victoria of Sweden. After her death the coach was altered in several details to make it fit the needs of the Crown Prince and Princess. It now has a lounge, intercommunicating single-rooms for the royal occupants, and a series of chambers for their attendants and maids.

New Danish Royal Saloon

At the inauguration of the Storstrøm bridge in September, 1937, a new Royal coach was used for the first time. Actually it was a birthday present from the State Railways to King Christian. The coach is the longest on the State Railways, being 23·5 m. (77 ft. 1 in.) overall, while the body is 22·2 m. (72 ft. 10 in.) long. The interior is according to His Majesty's wish made as plain as possible, and the coach is designed to be used for night as well as day travel on Danish and foreign railways. In one end of the car is a saloon 4·5 m. in length with indirect lighting, wireless, &c. The panelling is rosewood and the window framing is of sycamore; the upholstery is in blue. Next to the saloon are the Royal bedrooms, leading off a short corridor and with a bathroom between them. The next four compartments are destined for the attendants and are arranged similarly to modern sleeping car compartments. [Illustrations of these royal saloons will be found on page 762. —Ed. *R.G.*]



Plan of new saloon presented by Danish State Railways to King Christian
(*Also illustrated on page* 762)

FURTHER IMPRESSIONS OF OVERSEAS TRANSPORT

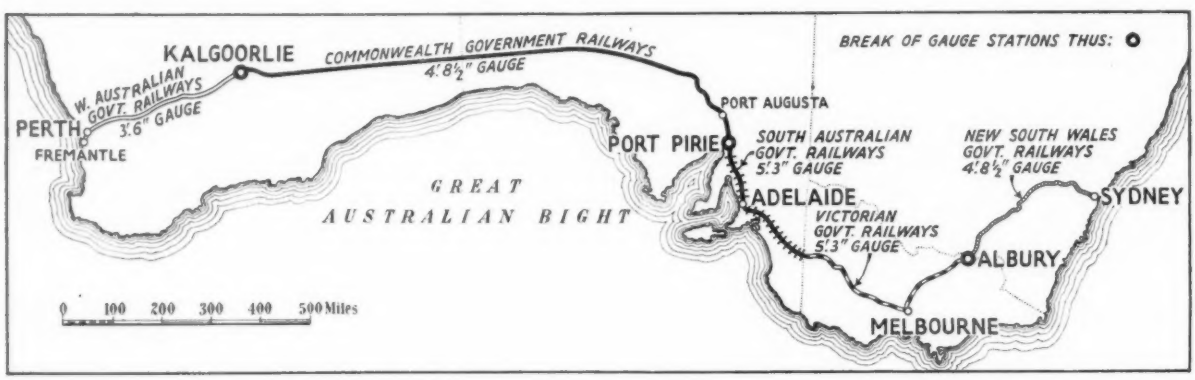
III—The author travels to Melbourne in the South Australian Overland express, and continues to Albury in the Spirit of Progress, the streamlined all-steel train of the Victorian Railways

By A. W. ARTHURTON, M.Inst.T.

THE journey from Adelaide to Melbourne is made in The Overland express, the coaching stock of which is jointly owned by the Victorian and South Australian Government Railways. The train is painted green and is composed mainly of first class sleeping carriages of the two-berth compartment type, which, by reason of the wide 5 ft. 3 in. gauge, are very roomy and comfortable. A separate Pullman sleeper is attached to the train in each direction, for which a supplement of 5s. to the ordinary sleeper fee of £1 is charged. New rolling stock, partitioned like the Pullman cars, is to be built for the Overland, but, being constructed of Corten steel, the cars will be much lighter in weight—42 tons 10 cwt. instead of 79 tons—and will provide more comfortable riding and be air-conditioned. Two or three composite first and second class coaches with seating accommodation are included in The Overland, which with the dining car usually comprises 11 vehicles. In view of the heavy gradients *en route* the train is hauled by large 4-8-2-type locomotives, weighing about 210 tons with tender. The train leaves Adelaide at 6.35 p.m. and reaches Melbourne (483 miles) at 9.35 the next morning. The corresponding westward Overland leaves Melbourne at 6.45 p.m. and arrives at Adelaide at 9.0 a.m. next day.

We have become accustomed to streamlined trains both in America and Great Britain, but a journey on the Victorian Railways Spirit of Progress, in which the transcontinental passenger travels between Melbourne and Albury, is a unique experience. Its originality, grace of outline, comfort and convenience are not only an effective reply to the challenge of the road but a demonstration of the ever-improving service which the Victorian Railways are offering their patrons. Painted a royal blue with longitudinal parallel bands of gold, its streamlined front with the letters V.R., and its rounded tail, it is most impressive. The conductors standing on the platform at the doorways to the coaches might be mistaken for R.A.F. men in their smart blue uniform and caps. A stewardess also travels on the train. She is attired in blue uniform with mess cap and her duties include all comfort services to women and children. A train stewardess is an innovation in Australian railway travel. The Spirit of Progress on my journey was hauled by the streamlined Pacific locomotive *Edward Henty*, one of the four Pacific locomotives which were recently named *Matthew Flinders, Edward Henty, Sir Thomas Mitchell,* and *C. J. Latrobs,* in commemorative reference to outstanding figures in Victorian early history. These locomotives each have a tender carrying 13,000 gallons of water and 8½ tons of coal, sufficient to ensure a non-stop journey between Melbourne and Albury, a distance of 190½ miles.

Some particulars of the passenger appointments and furnishing of this train were given in THE RAILWAY GAZETTE of January 7, and a poster reproduced in the same issue gave views of the dining and parlour-observation cars. What strikes the traveller most is the easy motion, the almost complete absence of noise and dust, and the comfortable temperature of the cars, due to the complete air-conditioning. A great deal of thought and skill has been invoked in providing a sound deadening foundation for the floor, which is incomparably superior to anything previously constructed on a train in Australia. Another outstanding feature of the train is the scheme of lighting. A lamp giving a soft diffused radiance, is set in a frosted globe in the ceiling of every compartment and above each passenger is a lamp operated by an independent switch. In the dining and observation cars, however, light comes from frosted troughs running along each side of the ceiling.



Trunk railways across the Australian continent showing ownerships and gauges

Shortly after leaving Melbourne we were called to the dining car where an excellent seven-course dinner was provided for 5s. The pleasing effect of the whole car is enhanced by the abundance of flowers and fruit. The car seats 48 diners.

In the sitting carriages there are eight compartments. Every compartment in the first class seats six passengers, and every second class compartment eight passengers. The design, appearance, and speed of the Spirit of Progress have made a great impression on recent English visitors. In fact it may be expected that some of the special features will be embodied in at least one of our own crack trains in the near future.

CHAPELON ON THE STEAM LOCOMOTIVE

A review of M. André Chapelon's important new book in which notable developments of the Stephenson locomotive are forecast, based on the perfecting of detail design

By E. L. DIAMOND, M.Sc. (Eng.), A.M.Inst.C.E., A.M.I.Mech.E.

M. CHAPELON'S eagerly awaited treatise on the steam locomotive* proves to be of a magnitude that might have been less astonishing in a past age when life was more leisurely and the responsibilities of those who design and maintain the equipment of a modern railway were less exacting. The great dearth of books, especially in English, on the theory and design of the locomotive may be attributed to the fact that those who alone possess the necessary experience to write them are generally too busy keeping abreast of the demands of the rapid developments of rail transport in recent years. It is therefore all the more remarkable that this monumental work should have proceeded from the pen of one who has contributed so notably to the recent development of the locomotive.

M. Chapelon explains in his preface that he has arranged his work with a view to making the task of the reader as light as possible, and to this end he has included a considerable amount of fundamental thermodynamic theory, so that reference to other text books is unnecessary. It is as well for the prospective reader first approaching the book to bear this in mind as otherwise he might be appalled by its dimensions. Indeed, if one may venture at the outset to make a criticism, it is that for the reader who, like all locomotive designers, ought already to be familiar with the classic theory of the steam engine, the task of seeking out what is new is not easy. In particular, the considerable amount of new data, obtained during recent French tests, which is embodied in this work, can be extracted only by a careful and protracted study. Despite the formidable appearance of the sections dealing with the thermodynamics of the steam locomotive, it is generally the case that in the final equations by which dimensions or efficiencies can be calculated, some crucial empirical factor enters, and experimental data by which such equations can be made more reliably applicable are the greatest need of the modern locomotive engineer.

The Blast Pipe

Nevertheless so clear an exposition of the theory of each function of the locomotive is essential if experiments are to be so conducted as to yield data of real value, and in cases where it is possible, M. Chapelon follows the excellent plan of building up generalised curves for particular relationships, with no numerical values, and then giving by way of example a set of curves with full numerical scales for a particular case. An illustration of this is the section on the blast pipe. A series of curves are first drawn showing the general nature of the relationships between the quantity of water evaporated, the smokebox vacuum, the back pressure, &c., thus enabling the author to analyse the factors making up the total effect of the action of the blast pipe; and finally an assembly of curves actually obtained for particular French locomotives is presented, from which conclusions can be drawn that would not be apparent without the preliminary analysis. In this instance the conclusions relate particularly to the case of variable blast pipes. Curves of evaporation on a base of smokebox vacuum, and of steam exhausted on the same base, plotted together, lie sufficiently closely to each other to show that the utility of the variable blast pipe is limited. The treatment of the all-important subject of the efficiency of the blast pipe in terms of the relationship between back pressure and evaporation rate is very thorough from the purely theoretical point of view, though perhaps the main impression remaining after such a study is a greater realisation of our lack of the kind of practical data necessary for precise design. M. Chapelon emphasises that the inadequacy of a boiler is often faultily ascribed to its dimensions instead of to the inefficient exhaust arrangements.

The book is divided into the following main sections: (1) A general review of recent developments, embodying a comprehensive account of modern locomotive types; (2) a study of the thermodynamics of the steam locomotive; (3) a study of the dynamics of the steam locomotive; (4) an analysis of the factors determining the power of a locomotive; (5) an account of the methods of testing locomotives; (6) points in the operation of the steam locomotive, and (7) a description with general arrangement drawings of a number of projected designs embodying the conclusions of the author regarding the attainment of both maximum efficiency and maximum power. Constructional matters are not primarily dealt with.

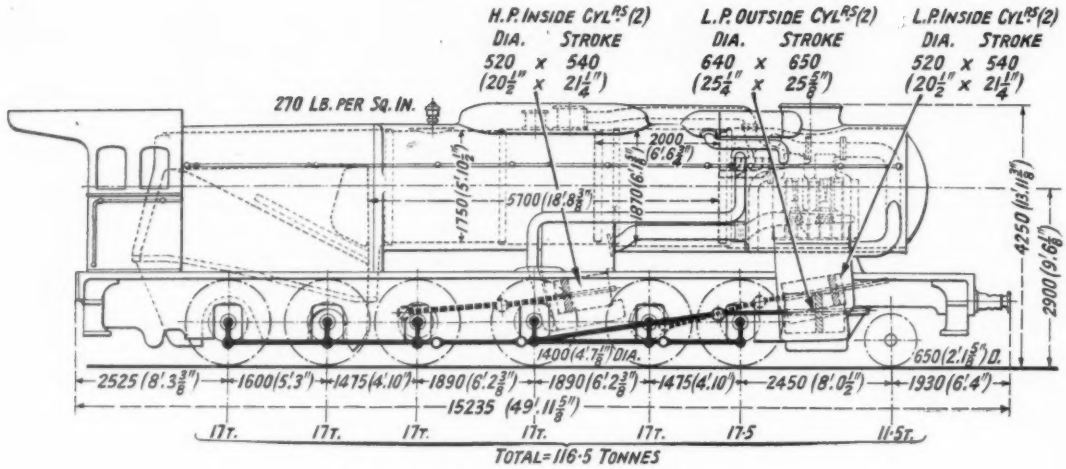
Remarkable New Designs

Interest will naturally be aroused in the last section enumerated above, since one may expect to find in these projected designs a visible embodiment of the results of the years of study and experience represented by the 900 pages of the book. Some of the drawings have therefore been reproduced on the following pages. They represent six main types of locomotive. Two are alternative designs for an express passenger locomotive with a maximum axle load of 22 *tonnes* and 29 *tonnes* respectively. Another is a high-speed locomotive, and the remainder are a freight-locomotive, a suburban tank locomotive, and a light high-speed tank locomotive respectively.

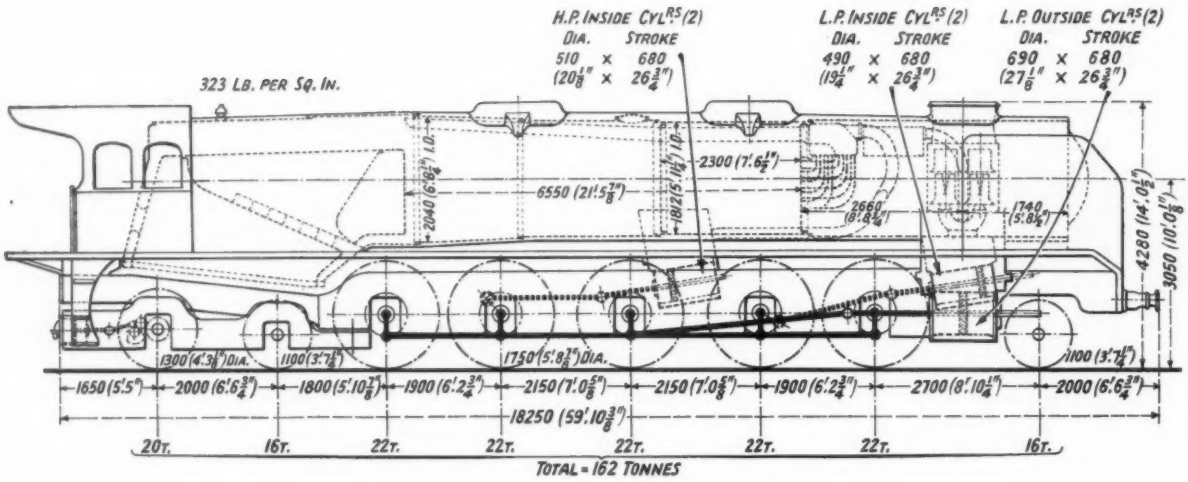
All these designs use compound expansion with a boiler pressure of 323 lb. per sq. in. (294 lb. per sq. in. for the light tank engine). As he has already indicated in his recent paper before the *Société des Ingénieurs Civils de France*,* M. Chapelon has arrived at the conclusion that when the design of steam passages and motion have been improved to the utmost extent the compound principle is necessary if full advantage is to be taken of those improvements in conjunction with high boiler pressures. It would be impossible, however, to accommodate two low-pressure cylinders of sufficient size to provide the power envisaged for these engines (4,500-5,000 i.h.p.), even within the French loading gauge, so for all but the tank engines and the high-speed engine, six cylinders are adopted, two high-pressure and four low-pressure. In the case of the passenger engines the cranks of the four low-

* La Locomotive à Vapeur. By André Chapelon. Paris, 1938: J.-B. Baillière et Fils, 19, Rue Hautefeuille, Paris, 6e. 10¾ in. × 8¼ in. × 2½ in. 914 pp. Many illustrations and 14 folding plates. Price, 125 fr.

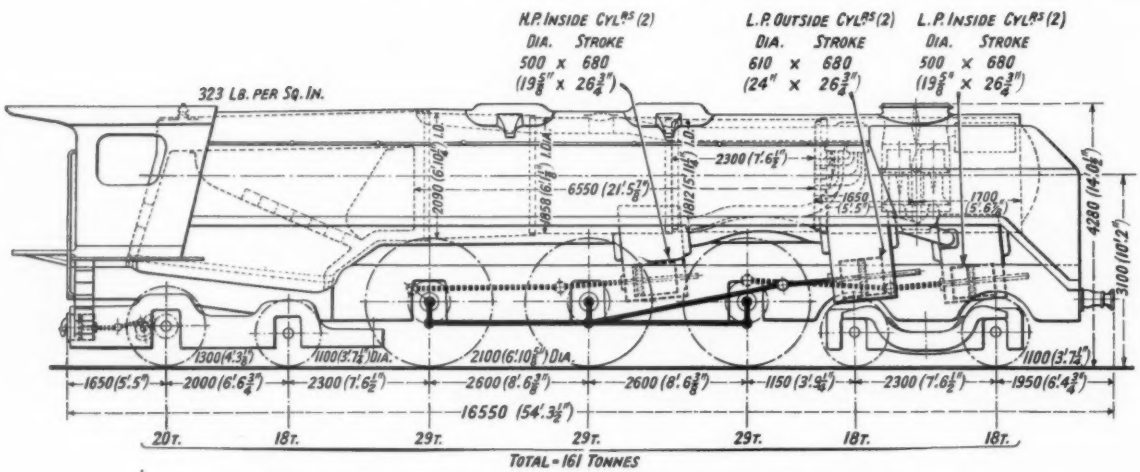
* Reviewed in THE RAILWAY GAZETTE of May 7, 1937, page 894.



Six-cylinder 2-12-0 freight engine



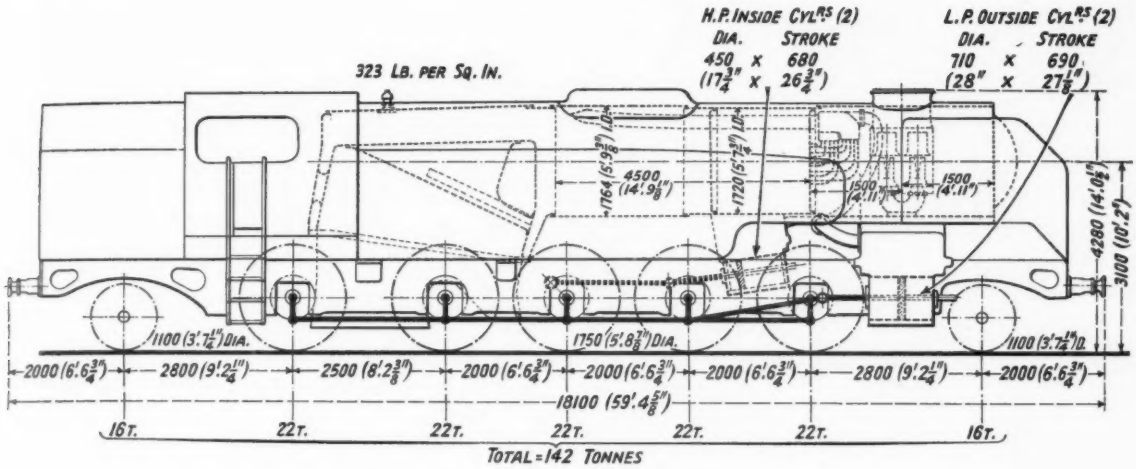
Six-cylinder 2-10-4 freight engine with booster



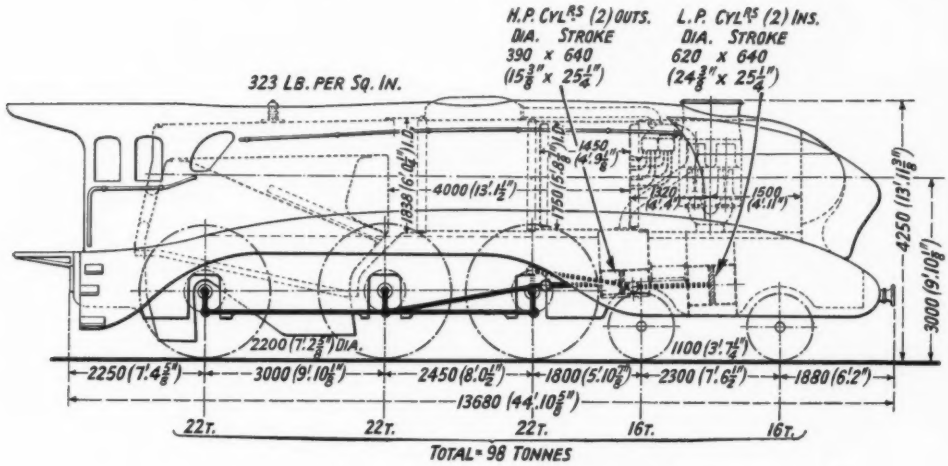
Six-cylinder 4-6-4 express engine with booster and 29-tonne axle loads

CHAPELON DESIGNS FOR

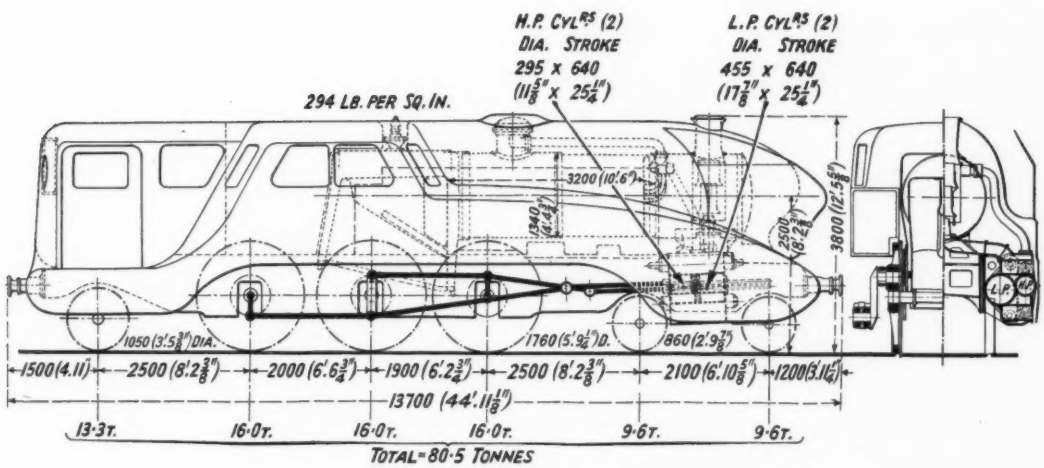
Referred to in Monsieur André Chapelon's



Six-cylinder 2-10-2 suburban tank engine



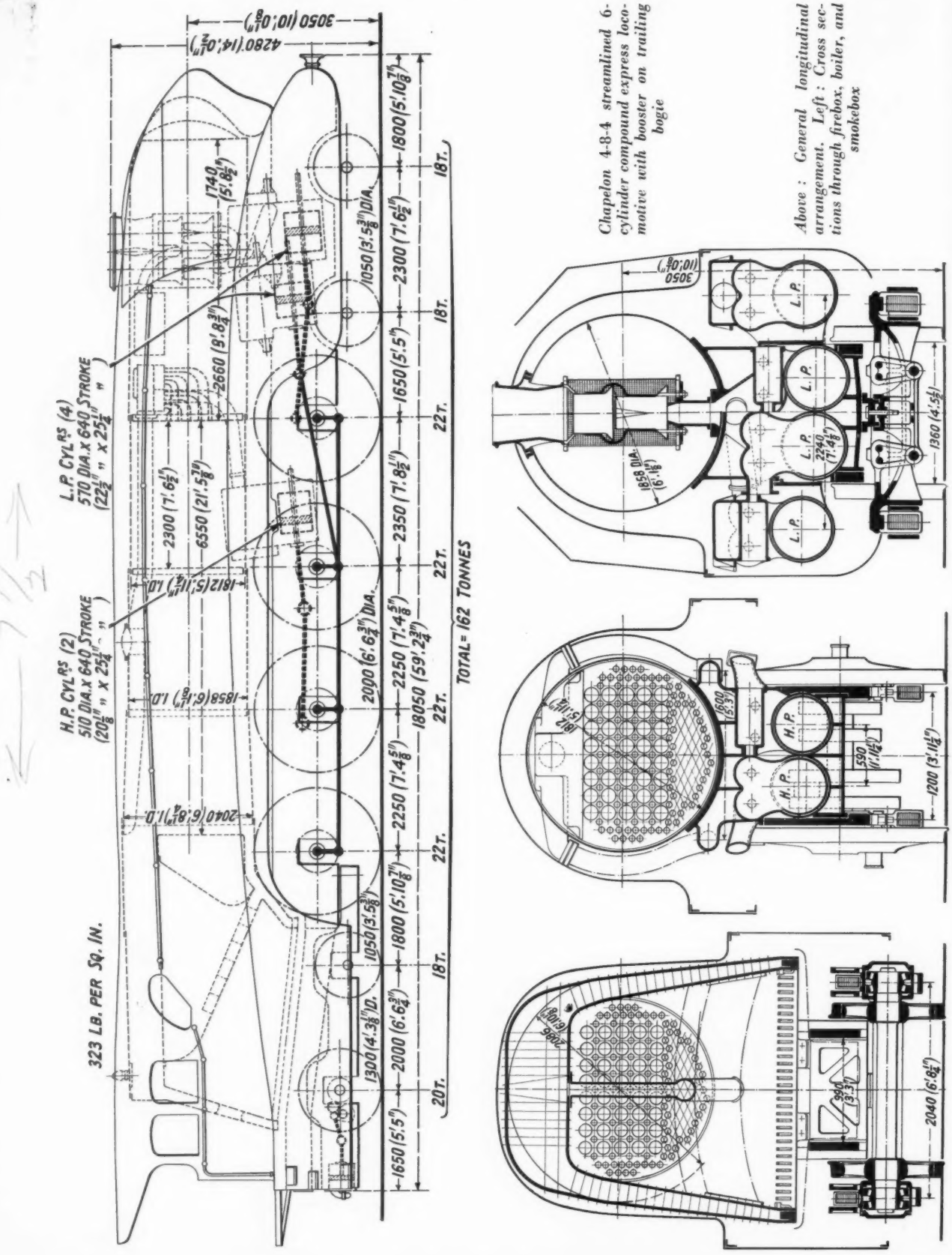
Four-cylinder 4-6-0 high-speed streamlined engine



Four-cylinder 4-6-2 high-speed light streamlined tank engine

COMPOUND LOCOMOTIVES

new book "The Steam Locomotive"



Chapelon 4-8-4 streamlined 6-cylinder compound express locomotive with booster on trailing bogie

Above : General longitudinal arrangement. Left : Cross sections through firebox, boiler, and smokebox

pressure cylinders are set at 180 deg., but for the goods engine, where the balancing of the reciprocating masses is of less interest than the evenness of the turning moment, the low-pressure cylinders work like a group of three cylinders with their cranks at 120 deg. Thus the inside low-pressure group comprises two cylinders whose total volume is equal to that of one of the outside cylinders, and whose cranks are disposed at 180 deg. to each other. The high-pressure cranks are in all cases arranged at 135 deg. in relation to the low-pressure.

For the smaller machines four cylinders are used, and in the high-speed tender engine the du Bousquet-de Glehn arrangement is reproduced without modification. In the suburban tank engine the low-pressure cranks are disposed at 135 deg. relatively to the high-pressure so that the engine works like a four-cylinder simple with cranks at equal angles, giving an extremely even turning moment. In the light fast tank locomotive the four cylinders are placed outside the frames in pairs, side by side, the high-pressure and the low-pressure pistons moving oppositely to each other.

A Discussion of Poppet Valves

It will be of great interest to note that M. Chapelon has adopted for all these projected locomotives Dabeg poppet distribution valves actuated by Walschaerts valve gear. The reasons for this are gone into exhaustively in the section of the book devoted to the thermodynamic study of the locomotive. It is pointed out there that in order to maintain a constant velocity of flow of the steam in the steam passages it is sufficient that the law of opening of the ports should be the same as the variation in speed of the piston in its course. This is illustrated with curves of the opening of the admission ports for various cut-offs with cams actuated by Walschaerts gear and with the Caprotti gear respectively, superimposed on a curve of instantaneous velocity of the piston. By a further series of curves it is shown that if the sections of the steam passages have been properly calculated for long cut-off, the rate of opening of the ports at short cut-offs with rotating cams is too rapid, whilst if their sections are correct for short cut-offs, the openings are insufficient at long cut-off. In M. Chapelon's opinion, therefore, it serves no useful purpose to subject the steam distribution mechanism to the extra fatigue consequent upon the sudden opening of the valves characteristic of rotating-cam steam distribution gears. The argument, however, seems to be open to criticism. In the first place the comparative curves are drawn for a Caprotti gear giving an appreciably smaller maximum opening than the Walschaert gear. Then, nothing appears to be said about the question of the closure of the valve, though actually at normal cut-off the piston is moving at a greater speed at the moment of closure than during opening. Finally, the loss by throttling at admission is less important than that at exhaust, and it may be claimed that the choice of a valve gear should be determined by its behaviour during exhaust rather than admission.

Returning to the projected designs, the steam passages have been designed on the same principle as in the rebuilt P.O.-Midi compounds, of which an account was given in the summary of M. Chapelon's paper already referred to, that is to say, the ratio between the sections across the ports and valves and the cross-sections of the cylinders is made as far as possible equal to 1/5 or even 1/4·5, and as ample as 1/3·5 in the case of the high-speed locomotive.

Novel Boiler Features

The boilers in the projected designs are pressed, as already indicated, to the highest pressure compatible with a superheated steam temperature of the order of 425° C., and are equipped with the Houlet superheater. They are also remarkable for two unusual features, namely, the Nicholson syphon fitted in the Belpaire fireboxes, and the division of the barrels by an intermediate tube plate to form a separate section constituting in effect a smoketube feed-water heater. The feed water is fed at normal temperature into the front portion. Thus the gases at the low-temperature end of the tubes encounter water on the counter-flow principle at a lower temperature than in the boiler proper, and so are capable of more effective heat transmission than could be attained with plain boiler barrels of this length. The heated feed water passes into the boiler proper by an orifice at the top of this intermediate tube plate. By this means the effectiveness of the long boiler tubes is greatly increased, and at the same time a simple means of obtaining a very satisfactory degree of feed water heating is provided.

The ratio of the free section across the large tubes of the Houlet superheater to the section across the small tubes is 1·20. The number of large tubes is slightly increased in the freight locomotive and the superheater is also augmented in the branch line locomotive on account of its frequent stops. For the most powerful of the locomotives the back tube plate is shaped so as to give a short combustion chamber without sharp corners, similar to the L.N.E.R. Pacific boiler. The smokeboxes are of sufficient length between the door and the blast pipe to avoid the level of the accumulated ashes interfering with the draught after runs of up to 500 km. with heavy trains.

It is impossible to conclude a review of this book without an expression of regret that so monumental a work has been published in so unworthy a form. For the sake of some half-tone reproductions, for the most part already familiar, the whole book is printed on the worst kind of coated "art" paper, which, apart from the fact that the letterpress prints badly on it and is tiresome to read, is of the most perishable substance and is unlikely to last even a human lifetime. Moreover, nearly a thousand pages of such heavy fragile paper are of such a weight that they will be difficult to bind satisfactorily. Books should be well designed like machines, and one feels that this book, in which moreover there are many misprints, is a poor embodiment of a work of technical exposition which must command the highest respect of all locomotive engineers.

Amateur Railway Photography in Germany

There may be travellers in Germany, who, perhaps vaguely troubled by thoughts of the reproving finger of authority, hesitate to take photographs of railway subjects, or do so in so furtive a manner as to arouse suspicions. Actually, however, what may or may not be photographed is clearly explained in an announcement recently issued by the German State Railway. This states that without specific permission photographs may not be taken of goods stations and yards, petroleum or oil tanks, of locomotive sheds and depots, water supply equipment and power stations, or of any railway premises which are not open to the general public. Otherwise there is no prohibition regarding taking photographs from such parts of the railway property as are open to access by travellers. Regulations permit the railway police, however, to forbid any photography which interferes with the working of the traffic. In Germany, as indeed in any other country, the railway authorities reserve to themselves the right to control the use made of their private property, and the co-operation of photographers in observing the restrictions is but a courteous return for the general permission to take pictures of premises open to the public.

BUCKLING IN WELDED TRACK

Experiments on German narrow-gauge line

SOME interesting particulars of experiments with welded track to determine the margin of safety against buckling are given by Herr Lederle of Pforzheim in the *Organ für die Fortschritte des Eisenbahnwesens* for December 15, 1937. They were carried out on a section of light metre gauge track on an electric line with the object of determining whether any marked advantage could be obtained by arranging the sleepers diagonally in alternate order, so making a given section of line into a form of lattice girder, earlier experiments having shown that danger of distortion existed with light track at a rail temperature of more than 50° C., and that even with heavier forms it was desirable to improve lateral stability. Two lengths of welded track were accordingly laid with diagonal sleepers, the first, 180 m. (590·5 ft.) long, the 40 lb. per yd. rails being supported on bearing plates and poplar filler strips, coach-screwed to pine sleepers. The second was 80 m. (262·4 ft.) long, on a curve of 82 m. (268·9 ft.) radius, with 55 lb. rails and similar fastenings but hardwood sleepers, both lengths being followed by similar ones with the sleepers laid in the customary manner. New ballast was laid throughout.

As soon as warm weather began careful measurements were taken at frequent intervals, and the straight section with transverse sleepers began to show a wave form of deviation which gave rise to unsteady running. When the rail temperature reached 50° C. this became pronounced enough to necessitate cutting the section into 50 m. (164 ft.) lengths.

With the diagonal sleepers no lateral distortion was observed but there was a slight tendency for the whole track to lift off the sleeper packing, in about 8 m. (26·2 ft.) waves, the beginning of vertical buckling. On the curved section with diagonal sleepers the latter remained secure at all temperatures, but the whole curve moved 12 mm. (0·47 in.) outwards at the highest temperature, subsequently returning to its original position. No distortion was noticeable from measurements made on 10 m. (32·8 ft.) chords throughout the curve. This was in marked contrast to the curve laid with transverse sleepers. Here a distortion of 10 cm. (3⅞ in.) at the ends occurred, at other places none, so that considerable irregularity was produced. The firm fixing of the rails to the sleepers so that the girder effect is obtained is, of course, essential, and it was found that the poplar filler strips provide this as long as the coachscrews were maintained tight.

The conclusion arrived at by Herr Lederle is that both practical experiment and calculation show the diagonal sleepering to be distinctly better than the conventional transverse form, due to the girder effect and the firmer hold of the sleepers in the ballast. There appears no difficulty in obtaining sufficient hold at the fastenings with ordinary coach screws so as to produce the effect of a solid braced joint, especially with the poplar filler strips and a hold requiring some 2,000 kg. (4,400 lb.) to disturb it appears satisfactorily obtainable. This is much greater than the worst disruptive effort that would be met with.

MORE SAVINGS ON INDIAN RAILWAYS

Notes derived from the Administration Report for 1936-37*

JOB analysis on the lines recommended by the Pope Economy Committee of 1933-34 was carried a considerable step further during 1936-37, and made possible a saving of Rs. 63·45 lakhs, or about £476,000, on the ten largest railways at a cost of only Rs. 1·89 lakhs (£14,175) expended upon job analysis organisation. On the North Western system alone Rs. 33,35,092 (over £250,000) were saved, a sum far higher than any previous annual saving on any individual Indian railway; in this instance the cost of organisation was less than $\frac{1}{20}$th of the amount saved. The North Western administration condemned 34 locomotives, 51 boilers, 127 coaching units, and 486 goods units (in terms of four-wheelers) without replacement during the year. Systems of cleaning and coaling engines by contract were adopted on the East Indian and Eastern Bengal Railways respectively, and effected considerable savings.

Success of Roller Bearings and Diesel Pumping Sets

On the G.I.P.R. the standard 4-6-0 locomotive fitted with roller bearings for its carrying wheels and extended bearings (13½-in. instead of 9-in.) for its coupled wheels, had by March 31, 1937, completed over 125,000 miles since it was turned out of shops, in October, 1935, with these modifications, and had been stopped during the intervening 17 months for only five "spare" days and seventeen repair days, thus effecting considerable savings in maintenance charges. The use of diesel pumping sets instead of steam at certain stations on the Assam-Bengal Railway reduced working costs by about 75 per cent. On the commercial side, the North Western Railway arranged to convert certain of its city booking offices to agencies worked by contractors and so effected appreciable economies.

Relaxation of Signalling Rules and of Signalling and Bridge Standards

The Railway Board appointed a committee in August, 1936, to ascertain whether an adequate measure of safety could not be maintained with less expensive standards of signalling and interlocking. As well as advocating the relaxation of certain over-stringent rules that were responsible for equipment in excess of actual requirements, the committee's recommendations contemplated a general increase of speeds, particularly through station yards; the elimination of refinements, which, though convenient, were not strictly necessary on grounds of safety; and the standardisation and purchase of fittings from established firms, instead of their being made departmentally. These measures, if adopted, must make for considerable economy. The Railway Board also approved certain reductions in the standard of strength of bridges and track, when renewed, more commensurate with the expected volume and weight of traffic.

The operating ratio of State-owned lines is only 51·4 per cent., or 65·2 per cent. including Depreciation Fund, and the ratio of net traffic receipts to capital at charge is 4·2 per cent.

* Reviewed in THE RAILWAY GAZETTE for February 18

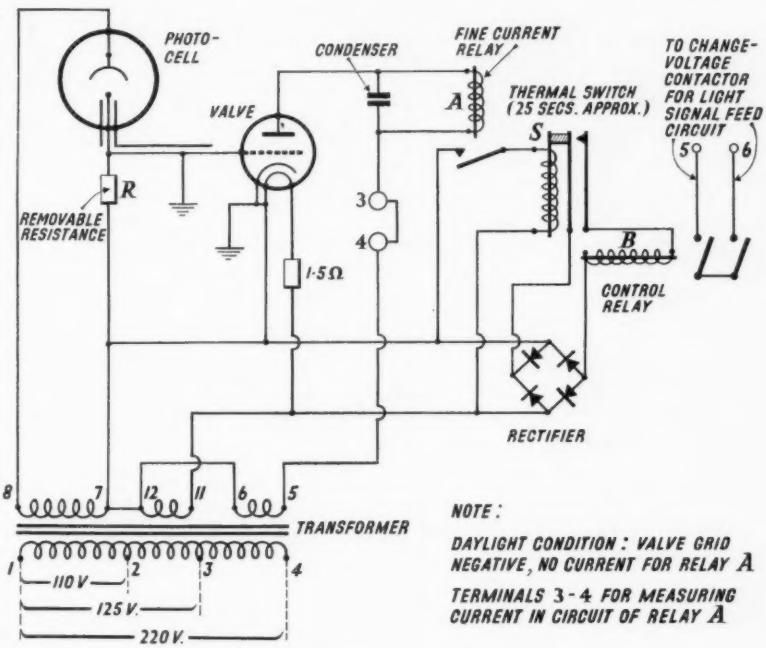
AUTOMATIC VOLTAGE CONTROL FOR LIGHT SIGNALS

Light-sensitive apparatus in Germany

It has not been considered necessary in this country to adopt a different voltage at night for colour-light signals with the object of reducing their intensity, but in some countries where the sunlight is very bright and the atmosphere exceptionally clear it has been found advantageous to do so, the indications at night being too glaring and hard on the driver's eyes if the intensity necessary for observation by day is used. If the change from one voltage to another is made by hand there is a risk of its not being carried out at the right time, and bad weather might come on and the signals not be switched on to the higher voltage as they should be. Automatic switch mechanism, actuated by means of a light-sensitive relay, has accordingly been used in some places. One of these is Kufstein, the Austro-German frontier station, which is equipped with a modern all-electric power signalling installation, and where hand control of signal voltage was at first used. The new equipment is described by Herren Gradl and Danninger in the *Zeitschrift für das gesamte Eisenbahn-Sicherungs- und Fernmeldewesen* for December 10, 1937, from which the accompanying diagram is reproduced.

The controlling relay consists of a photo-electric cell with valve of special make, mounted in a glazed casing with protective wire netting, and fixed in a suitable position on the wall of the station building. The cell is fed from terminals 7 and 8 of the transformer through the adjustable resistance *R*, by varying which the sensitivity of the apparatus to light can be set at any value desired. The cell being practically a non-conductor in darkness, the valve grid has no controlling negative voltage. The anode current comes from terminal 5 and can flow only during the positive half-wave. It acts on the fine current relay *A*, the armature of which is held during the missing half-wave by the charge in the condenser and in turn controls the thermal switch *S*, adjusted to work in about 25 sec., through which relay *B* is connected to the rectifier. This relay, when energised, operates the main change-voltage contactor (not shown) and thus maintains the light signals at night intensity. The purpose of the thermal switch is to prevent the signal voltage being changed over by a momentary variation in the surrounding light, as by smoke blowing past the detecting apparatus, a quickly passing cloud, or lightning flash.

When light falls on the cell the negative voltage on the valve grid increases, the anode current eventually ceases, and relay *A* drops away, resulting in the release of relay *B* after the thermal switch has returned to normal and the reversal of the signal voltage to the day value. The normal power consumption of the equipment is about 10 watts and the mains voltage can vary within 15 per cent. without affecting its reliability. Power is taken from the 16⅔-cycle railway supply—the normal arrangement—or the 50-cycle town supply, and hand voltage control can be used should the light-sensitive apparatus fail. If both power supplies fail an oil engine and generator can be started up.



Electrical connections for light-sensitive relay

The apparatus described has been in service since April 21, 1937, with very satisfactory results, a graph recorder showing the various periods of day and night voltage. On some occasions it has functioned during temporary dull periods occasioned by bad weather.

Berlin to Baghdad in 24 Hours

In pre-war years the proposed completion of the rail link between Berlin and Baghdad, with only the gap across the water at Istanbul, was one of the most notable pending developments, but the outbreak of war found the line uncompleted, and it is only now that the final link is being built. Meanwhile, passengers are able to travel by air from Berlin to Baghdad in 24 hr. with the introduction on March 27 of the summer timetable of the German Lufthansa. Since a distance of over 2,500 miles separates Berlin from Baghdad, this is the fastest regular passenger air service in the world. The plane leaves Berlin at thirty minutes past midnight and arrives at Baghdad at 10 minutes after midnight on the following day. Halts are made *en route* at Belgrade, Athens, Rhodes Island, and Damascus. At Baghdad connection is made with the Air France service to Hanoi (French Indo-China), while in Europe there are convenient connections with other European capitals. Another new service of the Lufthansa connects Berlin with Bucharest *via* Budapest. This is the first direct air service between the German and Roumanian capitals, and the 565 miles are covered in 6½ hours.

THE CHIEN TANG BRIDGE, CHINA

A description of the engineering works entailed in the construction of this fine structure, some of which are unusual

(*By our own correspondent*)

IN our issue of March 5, 1937, we gave a brief description of this bridge, but are now able to publish fuller engineering details of this important work, thanks to Dr. T. E. Mao, Engineering Director in charge, and to our own correspondent in China.

At the carefully-selected bridge site, the Chien Tang River is some 3,500 ft. in width, and the daily tidal variation ranges from 1 ft. to 8·7 ft. The velocity of the current in flood reaches 5·2 ft. per sec., and, when tide and flood have combined, a record velocity of 7·4 ft. per sec. has been recorded. The depth of water is greatly affected by scour, and December and July cross-sections normally reveal a difference of 20 ft. in depth; a 30-ft. difference was observed in 1935. At the edge of a cofferdam a scour of 25 ft. in 24 hr. was noted.

Red sandstone partly overlaid with serpentine was found at depths varying from – 40 ft. to – 50 ft. below normal bed level in the northern quarter of the cross-section, but about 1,300 ft. from the north bank there is an abrupt change in the rock level, which slopes away southwards to about – 140 ft. throughout the remainder of the bridge site; the rock is covered with sand and silt, and with some boulders at the south bank.

General Design

The loading of the bridge—which as previously mentioned is double-decked with a road over the single line of railway—is taken as equivalent to Cooper's E. 50, and the roadway loading that of 15-ton lorries. A headway of 30 ft. is allowed under the bottom booms at mean water level. The five northern main (220-ft.) spans are level, but the remaining eleven spans are on a gradient of 1 in 300, which is also the grade of the railway approaches; that of the road approaches is 1 in 25. The roadway after leaving the north end of the bridge is carried towards the hills on three steel arch spans—superimposed over the railway which is on embankment—and then continues on concrete trestles to divide into two roads at an angle of 120 deg. apart. At the southern approach there is only one arched road approach span and the road turns away in one direction only instead of bifurcating.

The main bridge spans are Chromador steel Warren trusses, 216 ft. centre to centre of bearings, 35 ft. deep, and 20 ft. apart; there are eight 27-ft. panels in each girder and the railway clearances are 22 ft. in height and 16 ft. in width. All this steelwork was supplied and fabricated by Dorman, Long & Co. Ltd. The 20-ft. roadway is of 8-in. concrete slabs supported on stringers, and the two 5-ft. footways are cantilevered out, one on each side of the roadway.

Substructure

The reinforced concrete piers are each 8 ft. 6 in. × 32 ft. at the top, and vary in height from 82·45 ft. to 112·98 ft., and are hollow to reduce weight. Each is supported by a pneumatic caisson 37 ft. × 58 ft. × 20 ft. deep, with a working chamber 7 ft. high. The five northern ones are founded on rock, and the remainder on clusters of piles driven to the rock. The piles under each of the nine southern piers are 160 in number and of Douglas fir, with 7-in. tip; their lengths vary from 75 ft. under the middle piers to 100 ft. at the south. The sixth pier from the north rests partly on rock at a depth of – 62 ft., but its south-western corner is supported by concrete piles 10 ft. to 25 ft. in length. The northern abutment rests on four open r.c. caissons founded on rock, but the south abutment is carried on 100-ft. timber piles driven to gritty sand at – 105 ft., almost as deep as the adjacent pier piles.

Method of Construction

The caissons for 14 piers were cast on land, carried by special 720-ton portal crane, or pair of gantry cranes, and lowered by spindling into the water to be floated to site. Each caisson was supported on I-beams and suspended by 12 spindle rods held by nuts on the top beams of the crane, three at each corner. Each spindle set consisted of a threaded rod which engaged the nut on the beam, and a series of short rods which were shackled together to give the required length and connected to the threaded rod at the top. In lowering the caisson the nut on the threaded rod was turned by a ratchet. To speed up the process a special mechanical device was evolved whereby the three ratchets at each corner moved together as a unit and the four units for the whole caisson were made to work at the same time.

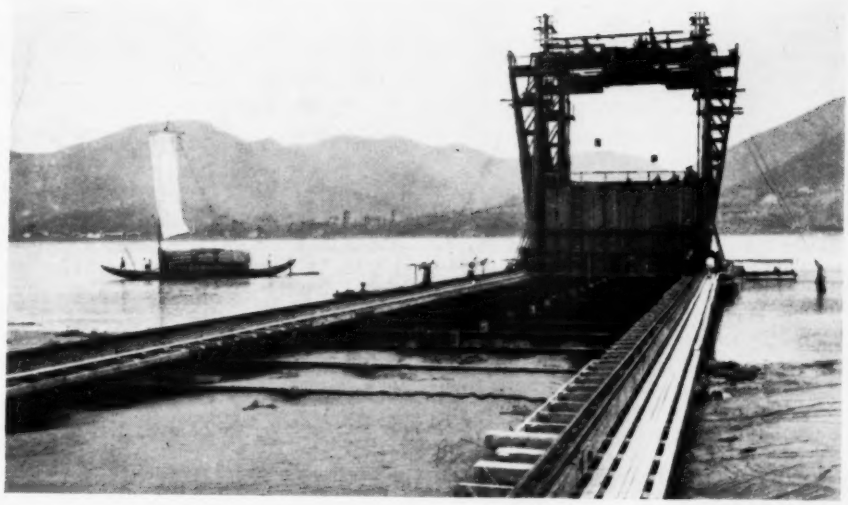
When the caisson had been lowered sufficiently to float, it was moved out of the crane by manipulating anchored wires from winches inside the cribwalls. The caisson leaving the trestle was then floated to the pier site, usually drifting on the current but guided by tugs. The site of the pier had previously been protected against scour by fascine mattress, 120 ft. × 180 ft. and 4 ft. thick, sunk by rubble stones. On reaching the site the caisson was anchored with six wires leading to 10-ton concrete anchors. After accurate adjustment of the location of the pier, it was sunk by excavation under compressed air.

Special Pile-driving Methods

The nine southern caissons were sunk to a depth of –40 ft., there to rest on the previously-driven pile clusters. To drive the piles to this depth a 65-ft. follower was used, and the piledriver was of the floating sheer-leg type with 120-ft. boom, and 140-ton capacity. A water-jet was first lowered at the exact position of the pile and to its full depth before withdrawal. The pile, hanging ready, was then pushed down into the jetted hole under the weight of the hammer. A few blows were sufficient to force it down to water level, after which it was driven with the follower until it reached rock with refusal. After some practice a gang of 14 men was able to drive 30 piles in a 24-hr. day.

With the exception of the last span on the south side which was erected on falsework, thanks to shallow water, all the remaining 15 spans were floated out to the piers. The spans were completely assembled on land, stored on two trestles and floated out on two timber barges. In moving each span weighing 260 tons, a special 200-ton "span car" was used under each end floorbeam. With this it was possible to jack up the span as well as to transport it on to the trestle. Since the span car had to move back and forth on the trestle, the spans were made to rest on a series of small bents which, being open inside, provided what may be termed a tunnel passage for the

Right: Caisson being lowered into the water by gantry cranes after having been cast on the shore and carried out along the trestle jetty by a pair of these cranes



Left: Caisson floated out from portal crane—seen in foreground—being warped into position for sinking at pier site

Right: Main span being floated out to the piers on two timber barges after erection on land. Raising was effected by pumping water out of the barges, and lowering by flooding them

THE CHIEN TANG BRIDGE, CHINA

Diagram showing the main spans as now demolished by the military

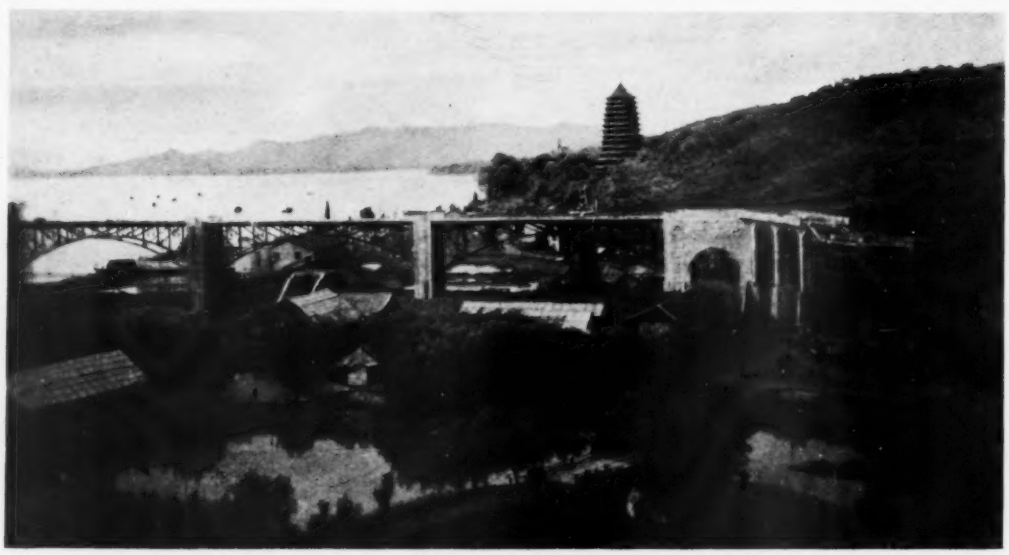
car. This enabled any span to be placed at any point on the trestle.

The span to be floated was first moved to the end of the trestle and jacked up by means of the span cars. When the span had been raised to the proper height, the two timber barges were warped in underneath to lift up the span by pumping out water ballast. The barges were then moved out from the trestle and towed toward the piers by manœuvring the anchored lines previously laid on the way. After reaching the piers, the span was lowered down by flooding the barges.

The work on the bridge was begun in April, 1935, and finished at the end of 1937. The total cost of the bridge was about $5,000,000, Chinese National Currency.

Unfortunately, almost as this article goes to press, we learn that this fine bridge has been almost entirely demolished in as far as the main girder spans are concerned. We are indebted to the *North China Daily News* for the diagram above, which shows that five of the spans have been wrecked and thrown into the river by explosives, detonated by retreating Chinese troops, and one pier has also been decapitated in a like manner.

Left : *General view of the bridge as nearly completed and showing the main spans and piers in the foreground. Note the hilly nature of the surrounding country*



Right : *Northern approach showing the road carried by steel arches above the railway —which is on embankment — until it bifurcates on the right on concrete trestles*

THE CHIEN TANG BRIDGE, CHINA

TRIALS OF ALSACE-LORRAINE TWO-CYLINDER PACIFICS

A correspondent makes a critical analysis of published test data obtained from two-cylinder simple express engines of large size

PUBLISHED results of trials with the two two-cylinder simple Pacifics of the Alsace-Lorraine Railways (see THE RAILWAY GAZETTE for August 4, 1933) show some interesting data as to the performance of cylinders and boiler. Both engines have Caprotti gear, but in one the cylinders are 22·6 in. by 28·4 in. and in the other 21·2 in. by 28·4 in.; the boiler pressure of each is 290 lb. per sq. in., the wheels 6 ft. 4½ in. in diameter, the adhesion weight 59 tons, and the engine weight 105½ tons. The boiler has an evaporative surface of 2,406 sq. ft., of which 201 sq. ft. is contributed by the firebox; the superheating surface is 794 sq. ft. (an increase on the amount provided originally), and the grate area is 48·4 sq. ft.

Tests over a period of nine weeks were conducted on a modification of the Czeczott method, the locomotive under test hauling a train consisting of the O.C.E.M. dynamometer car and two 4-6-0 braking locomotives which were used to keep the speed constant. As it was desired to conduct the trials on the constant speed, constant cut-off method it was arranged that the quantity of steam fed to the cylinders should be 29,750 lb. per hr. actual, corresponding to 12·29 lb. of steam per hr. at 290 lb. per sq. in. pressure per sq. ft. of evaporative heating surface, which was considered a normal rating. This was not metered between the regulator and the cylinders but was computed from the feed water delivery after allowance had been made for auxiliary consumptions.

Boiler performance

With coal of 14,000 B.Th.U.'s per lb. the maintenance of this output at a pressure of 284-290 lb. per sq. in. called for a firing rate of 78 to 82 lb. per sq. ft. of grate per hr. Although this firing rate is by no means excessive for such a locomotive, the corresponding boiler efficiency was only 66 per cent., no less than 22·5 per cent. of the heat in the coal fired being lost in the smokebox gases. The draught in the smokebox was only from 4·2 to 4·5 in. of water, and this poor boiler efficiency may be traced largely to the relatively small firebox. The grate area

Front view of Alsace-Lorraine 2-cylinder Caprotti 4-6-2 express locomotive

itself is ample, but the firebox volume above the grate is not sufficient to ensure proper combustion even at moderate firing rates. The first two Pacifics of the L.M.S.R., built in 1933, appeared to suffer in the same way, but the trouble was overcome by means of combustion chambers in the succeeding engines. These French and British examples indicate that with bituminous and semi-bituminous coals firebox volume is no less important than grate area.

Engine performance

The cylinder performance of these Alsace-Lorraine engines appears to be of a higher order. Caprotti valve gear with vertical-stem valves of $7\frac{7}{8}$ in. diameter is used, and the double-beat valves are almost fully balanced. Tests were undertaken at 37, 47, 56, 62, and 68 m.p.h., at respective cut-offs of 20, 16, 14, 13, and 12 per cent., which values corresponded to the desired constant steam consumption of 29,750 lb. per hr. Apparently full regulator was used, and the average steam chest pressure was 278 lb. per sq. in. The back pressure was 1·1 to 1·3 lb. per sq. in., but, as with the steam chest pressure, no distinction is recorded between the various cut-offs. The steam consumption at the above speeds was 14·76, 13·75, 13·46, 13·48, and 13·62 lb. per i.h.p.hr. respectively, with i.h.p.'s of 2,000 to 2,200. The coal consumption is claimed to have varied from 1.7 to 1.76 lb. per i.h.p.hr., but this is hardly substantiated by the figures given previously. If the average firing rate is taken as 80 lb. per sq. ft. of grate per hr., the hourly coal consumption is 3,900 lb., and as the average i.h.p. is 2,100, the coal consumption is 1·86 lb. *i.e.*, an increase of 6 per cent. above the value claimed.

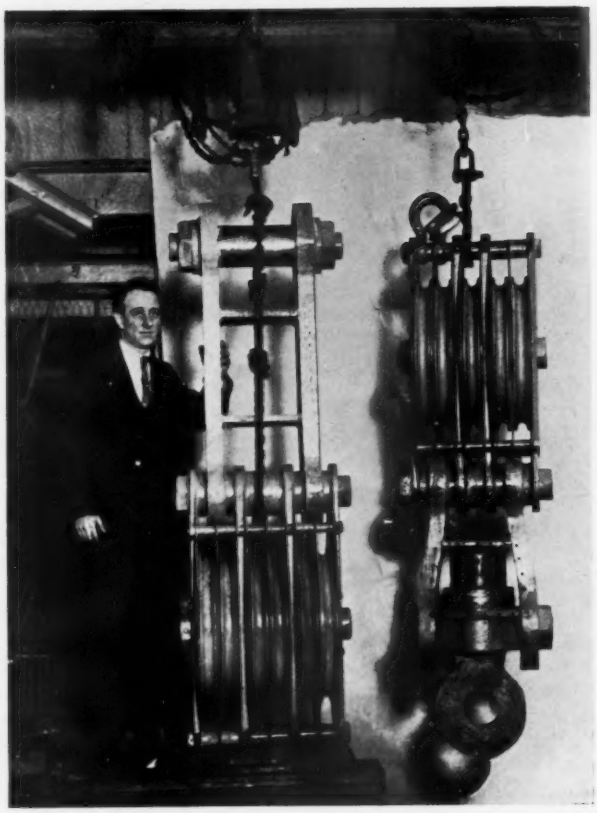
The Schmidt-type superheater was modified at an early stage by bringing the return bends of the elements to within 36 in. of the firebox tubeplate, compared with the surprising distance of 51 in. as built. (Length between tubeplates is 18 ft. 6 in.). This gave superheated steam temperature of 700-720° F. at the firing rates quoted earlier. The cylinder exhaust temperature was stated to be 226° F. at the back pressure of 1·1 to 1·3 lb. per sq. in., so that exhaust took place just before condensation would theoretically occur. The exhaust, too, could not have been much lower in pressure.

Further tests made at firing rates of 144 and 185 lb. per sq. ft. of grate per hr. merely confirmed the low boiler and high cylinder efficiency. The boiler efficiency fell to about 57 per cent. in the first case and about 48 per cent. in the second case, but the steam consumptions were constant at 15·7 lb. per i.h.p.hr. for respective i.h.p.'s of 2,950 and 3,170 at 62 m.p.h. The cut-offs necessary for these performances are not known.

Simple *versus* Compound

Much importance need not be attached to the claim that these results show the two Alsace-Lorraine locomotives to be as economical in consumption as very good compound locomotives. The locomotive weighs exactly the same as the Chapelon 4-8-0's of the P.O.-Midi. The optimum steam consumption of the Alsace-Lorraine engine is 13·46 lb. per i.h.p.hr. and about 16 lb. per d.b.h.p.hr. at 56 m.p.h., the coal consumption being about 1·85 lb. per i.h.p.hr. and 2·2 lb. per d.b.h.p.hr. Under optimum conditions the P.O.-Midi engine has a steam consumption (same boiler pressure) of about 11·2 lb. per i.h.p.hr. at 2,400 i.h.p. and a coal consumption of 1·33 lb. per i.h.p.hr. with injector feed. With feedwater heater in operation the coal consumption fell to 1·24 lb. per i.h.p.hr., and to a minimum of 1·215 lb. at 2,200 i.h.p. Taken on the basis of water at the tender, the Alsace-Lorraine locomotive shows a minimum of 11·4 lb. per i.h.p.hr. at 56 m.p.h. and about 2,100 i.h.p., whereas the Chapelon eight-coupled engine's best figure is 10·4 lb. per i.h.p.hr. at 68 m.p.h. and 2,400 i.h.p. Moreover, the P.O.-Midi engine has indicated over 4,000 h.p. compared with a known maximum of only 80 per cent. of that figure with the Alsace-Lorraine Pacifics, and at a coal consumption of 2·2 lb. per i.h.p.hr. compared with the 2·84 lb. of the Alsace-Lorraine engine at 3,170 i.h.p. These Alsace-Lorraine tests show how fine a cylinder performance can be obtained by the correct design of valves, motion, and steam and exhaust passages in simple-expansion locomotives having large cylinders specifically designed for habitual operation at low cut-offs (the Alsace-Lorraine system in general having comparatively light trains run for long distances at 74-75 m.p.h.), and they emphasise the importance of giving equal and adequate attention to both boiler and engine in order that the merits of one may not be penalised by the defects of the other.

100-ton Pulley Blocks



Designed to lift bridge girders weighing about 100 *tons, the two pulley blocks illustrated have recently been manufactured at the works of Loveridge Limited, Cardiff Docks, and supplied to a firm of railway contractors. The top block has been tested to* 170 *tons and the bottom block to* 150 *tons at Lloyds Proving House, Cardiff. The blocks, which have Timken roller-bearings, have a combined weight of over* $2\frac{1}{4}$ *tons. They will be put into use shortly in lifting a section of a railway bridge weighing* 100 *tons, and for this duty a locomotive is to be attached to the wire hauling rope*

A NEW LOCOMOTIVE WHEEL AND JOURNAL TURNING LATHE

Recently installed at the L.M.S.R. works at Crewe

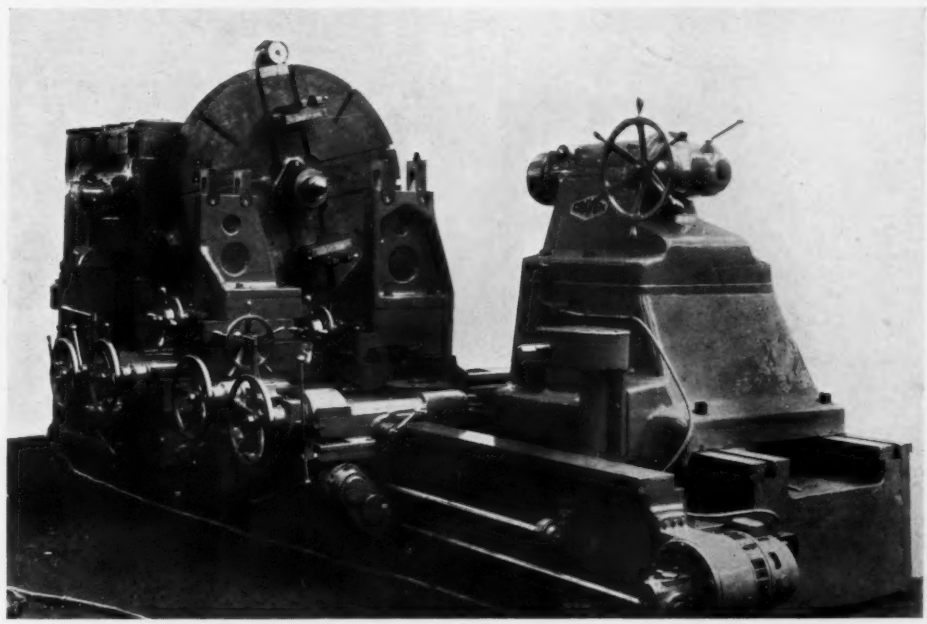
THE machine illustrated herewith has recently been supplied to the Crewe works of the London Midland & Scottish Railway, and was specially designed for finish-machining wheel centres after they have been shrunk on to the axle. It is arranged for turning the wheel-centre periphery, and facing the sides and boss; also for turning either inside or outside journals on straight or crank axles with the wheel centres in position. It will also turn both journals and pins of crank axles when the wheel centres are not fitted.

The machine has two saddles with lighthouse rests, enabling both wheel centres and journals to be machined at one setting. The range of spindle speeds and feeds permits the use of tungsten-carbide and high-speed steel cutting tools on wheel centres and axles. Special electrically-operated balancing in the faceplate enables the operator to set and balance any straight or cranked - axle wheel-sets in an absolute minimum of time.

The lathe has a centre height of 3 ft. 10 in., will admit a maximum of 8 ft. 6 in. between centres, and will deal with wheel centres from a minimum diameter of 2 ft. 9 in. to a maximum of 6 ft. 6 in. The totally-enclosed all-geared driving headstock has four changes of gearing, which, in conjunction with the 20-h.p. 3-to-1 variable-speed motor give spindle speeds of 8 to 85 r.p.m., making it possible for wheel centres to be turned at more than 700 r p.m. The hollow spindle is of close-grained cast iron and runs in adjustable capped bearings of special bronze, a large ball-thrust bearing taking the end pressure.

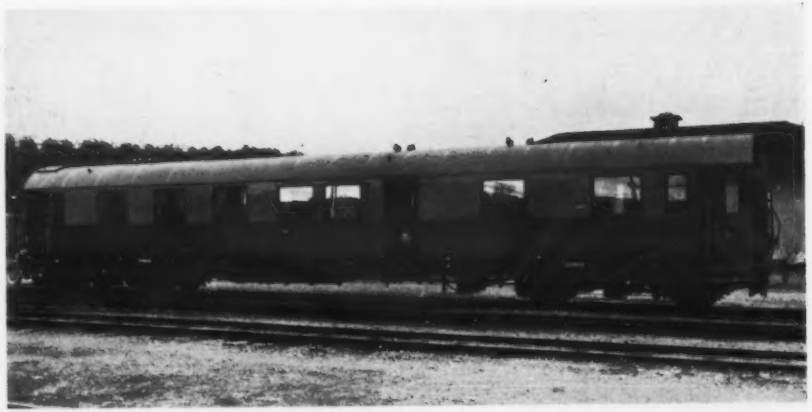
The gearing and shafts are of high-tensile steel, and the high-speed steel shafts rotate in either ball or roller bearings. The teeth of all high-speed wheels are ground on their profile, and the change-speed levers are in convenient positions in front of the headstock, all the change-speed motions being interlocked.

The 5-ft. 6-in. dia. faceplate is provided with tee-slots for securing the drivers, and has two balance-weights placed inside the back rim and adjusted by means of a built-in motor unit controlled by push buttons; the balance-weights are locked in position by locking screws. An ammeter is used as a guide for checking up the balance when the wheel-set is in position. The two drivers consist of rigid brackets with steel driving pins forked at the end, and provided with set screws to grips the wheel spoke, the pin in turn being clamped in the bracket. The pins slide right back into the brackets, well clear of the spokes, so that wheel-sets can be placed in the machine without the necessity of moving the loose headstock. The two saddles are mounted on the three shears of the bed, and have longitudinal and transverse variable self-acting power feed with hand and quick power traverse to both motions in each direction, and with feeds of 0·010 in. to 0·030 in. per revolution. The quick power traverse motion is obtained by a 2-h.p. motor, running at 1,400 r.p.m. The bottom slides of the saddles carry lighthouse rests, having hand adjustment for setting the tools. The hand and power feeds to the saddle along the bed are transmitted through worm and worm-wheel reductions and rack pinion on to a steel rack in the bed. The lighthouse rest slide has small transverse adjustment, and a large diameter micrometer dial is provided so that the operator can see the tool while adjusting it.

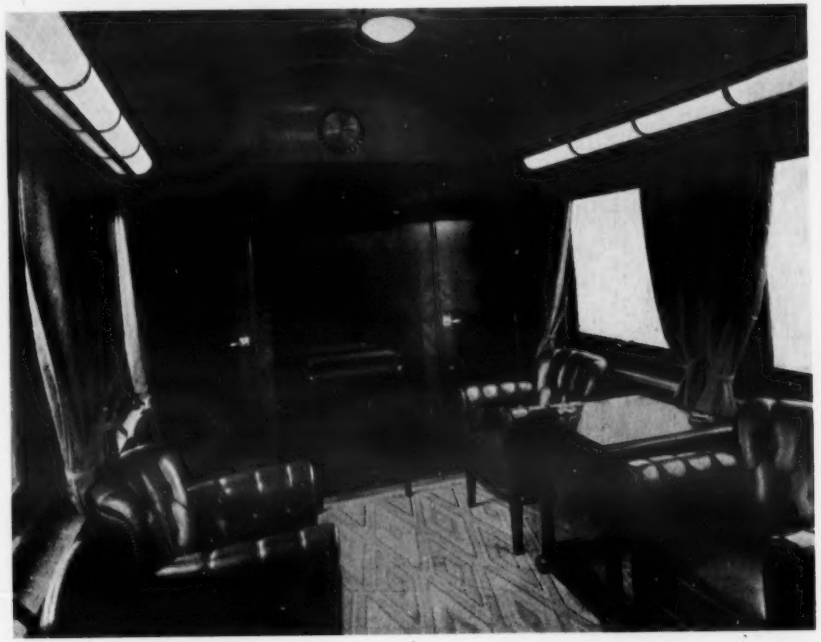


Craven wheel lathe in Crewe works, L.M.S.R.

A feed gearbox at the end of the bed is driven direct from the fast headstock by roller chain. It has four changes of feed in each direction. All gears are of heat-treated high-tensile steel, and the shafts are mounted on roller bearings. A slipping clutch embodied in the feed train protects the parts against overload. The movable headstock is mounted on a substantial packing piece and is adjustable along the bed by hand. It has a steel spindle of large diameter revolving on ball and roller bearings with dual-purpose bearings to take the end thrust. The spindle is adjustable by a large handwheel set at right angles to the centre of the machine, and is provided with locking pads. The tailstock centre has an enlarged end to support hollow large diameter axles. The machine was manufactured by Craven Bros. (Manchester) Ltd., of Reddish, Stockport, to whom we are indebted for the foregoing particulars and illustration.



Left : Exterior of Danish royal saloon with coats of arms of Denmark and Iceland. Right : Exterior of Swedish royal saloon. To the left of the side entrance is the private lounge, from which leads a corridor serving the King's sleeping compartment. The livery of the coach is dark blue below and a lighter blue above the waist line



Left : New Danish royal saloon : the day compartment with observation vestibule in background. Right : King Gustav of Sweden's royal saloon : the lounge compartment

SCANDINAVIAN ROYAL SALOONS (see page 747)

RAILWAY NEWS SECTION

PERSONAL

An Argentine Government Decree, issued on February 24 through the Ministry of Public Works, recognised the following as legal representatives of the Buenos Ayres South Dock Company, a subsidiary of the Buenos Ayres Great Southern Railway:—Doctors G. E. Leguizamon and Angel Sanchez Elia, and Messrs. Norberto M. Fresco, C. R. Schiller Harris, R. Stuart, and William J. White.

INDIAN RAILWAY STAFF CHANGES

Mr. D. Cardew, V.D., Chief Mechanical Engineer, N.W.R., was permitted to retire from Government service on January 27.

Mr. F. F. Parish has been confirmed as Deputy Chief Accounts Officer, State Railways, as from January 20.

Mr. G. C. Laughton, until recently Senior Government Inspector of Railways, Circle No. 7, Madras, and Agent designate of the B.B. & C.I.R., has been appointed Deputy Agent of that system preparatory to assuming chief executive office on April 9 next.

Mr. K. B. L. Mathur has been appointed to officiate as Deputy Chief Engineer, E.I.R., as from December 8 last.

Mr. R. E. Marriott, Divisional Superintendent, has been appointed to officiate as Chief Engineer, E.I.R., as from December 20 last.

Mr. J. C. Gibson, Deputy Chief Mechanical Engineer, has been appointed to officiate as Deputy Agent, Organisation, E.I.R., as from December 8 last.

Mr. S. E. L. West, O.B.E., has been appointed to officiate as Divisional Superintendent, Lahore, N.W.R.

Mr. R. Bonar has been confirmed as Deputy Chief Mechanical Engineer, E.I.R.

Dewan Bahadur Mathra Das, Director, Railway Board, has been granted 8 months' leave as from January 25.

Khan Bahadur Muza Har Huttain, Divisional Superintendent, N.W.R., has been appointed to officiate as Director of Establishment, Railway Board.

Lt.-Col. R. E. Gordon, M.C., R.E., Deputy Chief Engineer, N.W.R., has been appointed Officiating Senior Government Inspector of Railways, Circle No. 7 (Madras), with headquarters at Bangalore.

Mr. G. H. Mackley, General Manager of the New Zealand Government Railways, received the order of C.M.G. in the New Year honours (see our issue of January 7). Mr. Mackley was born at Port Chalmers in 1883, and educated at the Invercargill Grammar School. He joined the New Zealand Railways as a cadet in the traffic branch at Otautau, Southland, in 1900, and worked at various stations in the Southland and Otago districts until 1907, when he was made a clerk in the Goods Department at Christchurch. After being transferred on promotion to Petone station, and later to the Invercargill Goods Department, he was appointed Assistant Relieving Officer, and later Stationmaster at Heriot. Then he had five years as Stationmaster at Kaikohe and Onerahi, and was Assistant Relieving Officer in the Wellington district, later being promoted to the position of Divisional Clerk in the District Traffic Manager's office at Wellington, where he qualified as a train-running officer (1920-24), and was later transferred to Ohakune. For some of this time he represented the department before the Railway Appeal Board. He was Chief Clerk at Ohakune from 1925 to 1928, and was selected in September, 1928, to be Chief Clerk in the Head Office, Wellington. In 1931 he became Assistant General Manager, and General Manager in 1933.

Mr. G. H. Mackley, C.M.G.

General Manager, New Zealand Government Railways, who received the C.M.G. in the New Year honours, 1938

Mr. A. S. Chambers, a partner in James Chambers & Company (Manager Owner for the Lancashire Shipping Co. Ltd., Liverpool), has been elected a Member of the Mersey Docks & Harbour Board to fill the vacancy caused by the death of Mr. Thomas Stewart Rome.

The late Mr. James McCrea, the first General Manager of the Northern Ireland Road Transport Board, whose death at the end of last year was recorded in our issue of December 24, left personal estate in Great Britain and Northern Ireland valued at £34,718.

The late Mr. Douglas Vickers, whose death on November 23 last was recorded in our issue of December 3, left estate valued at £219,710 (£202,902 net). Mr. Vickers had been Chairman, and later President, of Vickers Limited, and a Director of that company and of the L.M.S.R. until his death.

Mr. Robert Flack, Chief Accountant, Central Argentine Railway, sailed for England on leave of absence on March 11.

Mr. L. A. Woodbridge, M.Inst.C.E., Chief Engineer, Central Argentine Railway, left Buenos Aires for the United States and England on a pleasure and business trip on March 15, travelling *via* Chile and the West Coast.

On March 4, Engineer Atanasio Iturbe (Chairman, Local Board, Central Argentine Railway), Dr. G. E. Leguizamon (Chairman, Local Boards, B.A.G.S. & B.A.W.R.), and Messrs. W. J. White, J. Calder Angel, and Dr. A. Sanchez Elia (Local Directors), called on the new President of the Argentine Republic, Dr. Roberto M. Ortiz, at Government House, Buenos Aires, to pay their respects to His Excellency on his assumption of office. On March 9, Dr. Luis P. O'Farrell, Chairman, Local Board, Buenos Ayres & Pacific Railway, and Mr. M. F. Ryan, C.B.E., General Manager, and Mr. C. R. S. Harris, Director-General, B.A.G.S. & B.A.W.R., visited the President for the same purpose.

Streamline Enterprise on the Santa Fé

New developments in the express train services on the Atchison, Topeka & Santa Fé Railroad of America will, it is claimed, make this company the greatest railway user of diesel-electric power in the world, owning locomotives with a total of 23,400 h.p. in train haulage, and 7,500 h.p. in switching service. Combined with this diesel programme is a remarkable extension in the use of lightweight streamlined stock, to a total of 151 vehicles in all, assembled into thirteen streamlined trains, of which twelve are entirely new. Seven of these trains use, or will use, diesel-electric power, and the remaining six will be hauled by the new type of streamlined steam 4-6-4 express engines recently introduced by the Santa Fé. One of the last-mentioned figures in the centre of the photograph of five of the Santa Fé streamliners reproduced above; the other four are diesel propelled.

Five streamlined Santa Fé express trains at Chicago. In the centre is the Chief, with streamlined 4-6-4 steam locomotive, and on each side are diesel-electric locomotives

The Santa Fé possesses its own tracks throughout from Chicago to the Pacific coast, unlike the principal competing service to Los Angeles, which uses the tracks of the Chicago & North Western, Union Pacific and Southern Pacific lines. In competition with the latter's diesel-electric City of Los Angeles train, the Santa Fé introduced a couple of years ago the Super-Chief, composed at first of ordinary stock but hauled by a diesel-electric locomotive; last year this was replaced by a complete set of streamlined cars with diesel-electric propulsion, and on February 22 of this year a second unit was introduced; the round journey of 2,228 miles from Chicago to Los Angeles and back to Chicago, previously made once weekly, is now made twice every week, in a time of 39¾ hr. This requires an average speed of 56·1 m.p.h. throughout, including the mountain districts of Colorado, New Mexico, Arizona, and California, which make up fully one-half of this distance. They include Raton pass (7,622 ft.), Continental Divide (7,248 ft.), and Flagstaff (7,000 ft.), followed by a drop to 483 ft. at Needles before climbing to 3,822 ft. in the Cajon pass, with gradients up to 1 in 26; from Trinidad to Lynn, at the east end of Raton tunnel, for example, the line climbs 1,545 ft. in 16 miles. The new train consists, apart from the 3,600 h.p. twin power unit cars, of nine passenger cars. Of these the first is a baggage-lounge car, followed by three compartment sleeping cars of different types, with "roomettes," single and double bedrooms; the fifth car is a cocktail lounge car with barber shop, shower bath, and quarters for the crew; this is followed by the dining car, another compartment sleeping car, a "section" sleeper, and a combined sleeping-observation car at the rear, all on roller bearings. The Super-Chief is an all-Pullman service.

The competing City of Los Angeles carries both Pullman and "coach" passengers, and to extend the scope of the competition the Santa Fé therefore put in service, twice weekly from February 22 last, two more streamlined trains with diesel-electric power, which tie in travelling time—39¾ hr. between Chicago and Los Angeles—with the Super-Chief, but are reserved exclusively for "coach" passengers. To provide such high speed in a special service for the equivalent of the English third class passenger is a complete novelty in American operating arrangements. The El Capitan sets each consist of five cars, two of which are chair cars, followed by a restaurant car and combined chair and observation car, and preceded by a chair car with baggage space and a dormitory for the crew. Sleeping on the two nights of each journey is provided for with luxurious double reclining chairs of the latest type, which can be tilted to any desired angle and also swung round towards the windows; accommodation is provided for 192 passengers. The restaurant car, 83 ft. long, incorporates a lunch counter with fourteen places, a dining section with 24 seats, and kitchen. Diesel-electric locomotives of 1,800 h.p. are used for this service. El Capitan leaves Chicago at 5.45 p.m. on Tuesdays and Saturdays, and the Super-Chief at 7.15 p.m. on the same days, reaching Los Angeles at 7.30 and 9 a.m. respectively on Thursdays and Mondays, so that in effect only the one intervening day of business is spent on this 2,238-mile journey, 2 hr. being gained *en route* by the difference between Chicago and Pacific time. Return of El Capitan from Los Angeles is at 1.30 p.m., and of the Super-Chief at 8.0 p.m. on Tuesdays and Fridays, reaching Chicago at 7.15 a.m. and 1.45 p.m. respectively on Thursdays and Sundays, four 39¾-hr. runs being thus made by the Santa Fé between Chicago and Los Angeles each week.

In addition to these the long-established Chief service of the Santa Fé between Chicago and Los Angeles has now been provided with streamlined lightweight stock. In view of its daily operation and lower speed, six sets of cars have been built to provide adequate equipment. The train is not hauled by diesel-electric locomotives, but by the latest type of Baldwin-built streamlined 4-6-4 steam locomotive, which is also used on the high-speed trains in the event of any temporary failure or overhaul of one of the diesel-electric sets. A fourth Santa Fé streamlined service, requir-

ing the provision of two lightweight seven-car trains, has operated daily between Chicago and Kansas City from April 1, the distance of 451 miles, including stops, being covered in 7½ hr. each way, or at an average of almost exactly 60 m.p.h. These will be day trains with accommodation for 300 passengers; one will be called the Chicagoan and the other the Kansas Cityan. Last of the new trains is the San Diegan, also streamlined and with diesel-electric power; this was introduced in mid-March, and is a five-car train making two double journeys daily over the 126 miles between Los Angeles and San Diego in 2½ hr. All the club-baggage, lounge, dining, and chair cars of the new Santa Fe trains have been built by the Edward G. Budd Manufacturing Co., of Philadelphia, and the Pullman sleepers for the Super-Chief and Chief by the Pullman Standard Car and Manufacturing Co. of Chicago.

RAILWAY AIR SERVICES CONNECTIONS WITH SHETLANDS.—From May 2 the London-Glasgow route of Railway Air Services will make a connection at Glasgow with Northern & Scottish Airways for the Shetlands (*via* Inverness), enabling passengers from Croydon to reach Lerwick in one day. The main London-Glasgow service will from this date proceed direct to Glasgow from Liverpool, a connection from Liverpool providing the existing Liverpool-Belfast, and Belfast-Glasgow facilities.

SOUTHERN RAILWAY TRAINING SCHEME.—The Southern Railway has, near East Croydon station, a training school open to all members of the staff, where evening classes are held during the winter months in signalling, rules and regulations, and operating generally, also accounts and station working. A new feature is the recent introduction of courses in cartage operation and road transport legislation, and road vehicle operation and maintenance. The present building is the successor of one erected by the L.B.S.C.R. in 1912, when classes in signalling and other subjects for the Head Office clerical staff were instituted. In 1923, on the formation of the Southern Railway, the school was made available to the staff of all sections of the constituent companies, and free travelling facilities were provided to those attending. The original building was demolished in 1935 owing to the site being disposed of, and new premises were erected nearby. The present school contains a 2½-in. gauge fully signalled model railway with double junction and interlocking frame, with track circuiting and other modern signalling devices. A "cut-away" engine and chassis of a motor lorry are provided to demonstrate the mechanism and working of such a vehicle. On March 31 over 200 students of the school who had passed the examinations for the 1936-37 season were presented by the Traffic Manager, Mr. E. J. Missenden, with their awards.

Railways and Air Bookings

Arising out of the debate in the House of Commons on April 5 when a member proposed the inclusion of a clause in the L.M.S.R. Bill to limit railway restrictions on general air bookings by their agents, Sir Josiah Stamp clarified the railway attitude in the following letter published in *The Times* of April 7:—

"Sir,—On the Report stage of the L.M.S. Bill last night a motion was made for the addition to the Bill of clauses dealing with the use of railway agencies by independent air operators. These clauses were ruled out of order, but certain statements were made—and have now been published—which, either because they were left incomplete by the mover, or because there was no opportunity for reply, may leave an impression as to the position of my company misleading to the public and even to our shareholders.

"May I say at the outset that, while the major part of the air mileage run by Railway Air Services is on behalf of the L.M.S. Company and at its risk, there are not, in fact, at the present time any cases, lying within the sole discretion of this company, of internal air services run by others in which there is any embargo or bar upon air bookings in agencies supported by L.M.S. business.

"On the general question, however, our position is as follows:—

"Over a long period of years we have built up a system of facilities for the sale of our tickets, either in offices under our own immediate direction by salaried employees and the direct provision of overheads, or by agencies whose remuneration is by commission on results on a scale adequate to cover their overheads and provide them with a profit. (Obviously, the rate of such remuneration ultimately bears a relation to the volume of business to be done, and whatever financial assistance it may indirectly receive by other work done by the agencies in general, those agencies would, in fact, either not exist without the railway business or be unable to conduct their remaining business on its present terms.) These agencies vary in their dependence upon the L.M.S. business, but in any case the arrangements do not differ in character from those common in many branches of commerce where the terms upon which business is done are the subject of ordinary negotiation.

"Now the L.M.S. management, with the approval of the shareholders and having regard to its responsibilities as a comprehensive transport organisation, is taking a long-range view of the internal air problem, and is prepared to face the certainty of deficits in air working for a considerable period in the hope that there will be an ultimate justification and national advantage. My company is the more ready or able to do this because of its existing organisation and its facilities for co-ordinating air and other forms of travel, and it is willing to help the air system to be built up also by others by the use of these facilities where this can, in the interests of public policy, properly be done.

"The obligations now sought to be imposed upon the L.M.S. would mean that it would be open to any newcomer in this field, however fully it might be already covered, to have without any question, conditions, or preliminary discussion, the full use of our ticket agencies, and that also without any reciprocal obligations.

"The cases fall under three heads:—

"(*a*) Those in which the services proposed do not directly compete with our air services, existing or in preparation: in this no objection is raised by us as to the use of booking facilities with our agents.

"(*b*) Those in which the services are directly competitive with ours and where every booking by an agent is almost certainly a diminution of the bookings over our own air lines. These are cases in which under commercial practice, and in the interests of our shareholders, we think we should have the right to discuss conditions. Moreover, there is abundant evidence for saying that it is not in the national interest for the duplication of services over routes that will only financially support one service to be too easily facilitated. But even in these conditions the cases have all been accommodated.

"(*c*) Those in which a company may be barred from the booking of its non-competitive services because it is operating on competitive ones. Here the relationship is more indirect, though the financial assistance given by our system to the overheads of such a concern may not be unimportant. But, in fact, we have by negotiation met such cases.

"The above briefly sets out matters which to be fully understood in every aspect would require more detail and more space. I will make no extended comment here upon the constitutional question raised by the inclination to attempt to impose upon particular concerns like the L.M.S. obligations or restrictions (which are of a general commercial or industrial character and should, if valid, apply to everybody) merely because those concerns have statutory obligations to obtain Parliamentary powers for particular activities. Whatever may be said for bringing in matters which, while extraneous to the Bills, are peculiar to the company promoting them, it is a much wider stretch of political propriety to single those concerns out for specific pressure upon general issues.

"Therefore, in this discussion a distinction should be made between 'stifling competition' and lending one's facilities to promote it; between an attempt to 'establish monopoly' and a desire to avoid suicidal overlapping by rationalising, co-ordination, and economy of resources; between oppression or 'restricting trade' and having reasonable rights of negotiation of agency conditions; between imposing a policy, which is really general in character, upon particular concerns because of an accidental opportunity, and reasonable criticism of the powers in a Bill and of action particular to its promoters.

"In no case do my company wish the matter to go beyond the limits of the latter alternatives."

LEGAL AND OFFICIAL NOTICES

In the Court of the Railway Rates Tribunal.

Road and Rail Traffic Act, 1933.

Agreed Charges.

NOTICE IS HEREBY GIVEN that Applications for the approval of Agreed Charges under the provisions of Section 37 of the Road and Rail Traffic Act, 1933, short particulars of which are set out in the Schedule hereto, have been lodged with the Railway Rates Tribunal.

The Procedure to be followed in regard to the inspection of the said Applications and the filing of Notices of Objections is that published in the *London Gazette* of 28th July, 1936.

Printed copies of the Procedure can be obtained from the Railway Rates Tribunal, Bush House, Aldwych, London, W.C.2.

Notices of Objection to any of the said Applications must be filed on or before the 29th April, 1938.

A copy of each Application can be obtained from Mr. G. Cole Deacon, Secretary, Rates and Charges Committee, Fielden House, Great College Street, Westminster, London, S.W.1, price 1s post free.

T. J. D. ATKINSON,
Registrar.

6th April, 1938.

Number of Application	Name of Trader and General Description of Traffic
1938—No. 191	CHAPMAN & DUNN LIMITED, 70, Dock Street, Newport, Mon.; Self-Raising Flour and Groceries.
1938—No. 192	J. T. DOBBINS LIMITED, Crown Mills, Charlton Place, Ardwick Green, Manchester, 1; Cotton Waste and Rags; Cotton and Linen Goods. (*Applicable also to traffic consigned by one Associated or Subsidiary Company.*)
1938—No. 193	KINLOCH (PROVISION MERCHANTS) LIMITED, Overbury Road, London, N.15; Groceries, Preserves, Provisions, etc.
1938—No. 194	W. H. COTTON & SONS LTD., Earl Shilton, Leicester; Boots and Shoes.
1938—No. 195	ANDREW LEVY & CO. LTD., Bowershall Mills, 79, Bonnington Road, Leith; Stationery.
1938—No. 196	LISSEN LIMITED, Angel Road, Edmonton, London, N.18; Accumulators, Dry Battery Cells, Light Aluminium Castings, Wireless Receivers, Electric Lamps, Sparking Plugs, Bakelite Mouldings, etc. (*Applicable also to traffic consigned by one Associated or Subsidiary Company.*)
1938—No. 197	RICHARD & CO. LTD., 10-18, Goswell Road, London, E.C.1; Clocks, etc.
1938—No. 198	JOSEPH W. WHITWORTH LIMITED, Longbottom Mills, Luddendenfoot, Yorks; Blanket and Cloth.
1938—No. 199	RICHARD & CO. LTD., Aldersgate House, London, E.C.1; Clocks.
1938—No. 200	M. TEMPEST & SONS, 41, Peel Place, Leeds Road, Bradford, Yorks; Woollen Goods.
1938—No. 201	WHITELEY ELECTRICAL RADIO CO. LTD., Victoria Street, Mansfield; Wireless Component Parts.
1938—No. 202	ROGALLS (LEEDS) LIMITED, Spark Street Mills, Leeds, 3; Confectionery.
1938—No. 203	UNITED WALLPAPERS LIMITED, Dundee Road, Trading Estate, Slough; Paper Hangings.
1938—No. 204	MASTERS & CO. (CLOTHIERS) LTD., 28-31, St. Mary Street, Cardiff; Gents' Outfitting.
1938—No. 205	BUTLER SERVICES LIMITED, Dockfield Road, Shipley; Clothing, Drapery and General Stores Wares.
1938—No. 206	BRADFORD TEXTILE CO. LTD., St. Blaize Works, Snowden Street, Bradford, Yorks; Clothing and Caps.
1938—No. 207	GRAINGER & SMITH LIMITED, Dudley; Clothing, Drapery, etc. (*Applicable also to traffic consigned by five Associated or Subsidiary Companies.*)
1938—No. 208	ISMAY DISTRIBUTORS LIMITED, Sterling Works, Dagenham, Essex; Electrical Appliances; Neon and Tubular Electric Signs; Wireless Apparatus, etc. (*Applicable also to traffic consigned by four Associated or Subsidiary Companies.*)
1938—No. 209	SHEPHERDS INDUSTRIES LIMITED, 7, Park Lane, London, W.; "Frittles."
1938—No. 210	J. A. CRABTREE & CO. LTD., Lincoln Works, Walsall; Electrical Accessories and Fittings, etc.
1938—No. 211	T. MELBOURNE JONES, Glyndwr Stores, Llandissilio, Clynderwen; Rabbits (dead).
1938—No. 213	CLYDESDALE SUPPLY CO. LTD., 2, Bridge Street, Glasgow, C.5; Electric Batteries, Radio Goods, Musical Instruments, etc.
1938—No. 214	COOPER BROTHERS (NOTTINGHAM) LTD., Hadyn Road Works, Nottingham; Hosiery.
1938—No. 215	J. ENGLISH & CO. LTD., 8, Lloyd's Avenue, London, E.C.3; Disinfecting Fluids, Edible Oils, etc. (*Applicable also to traffic consigned by one Associated or Subsidiary Company.*)
1938—No. 216	J. EVERSHED & SON LTD., 81 to 83, Eastern Road, Brighton, 7; Soap, Soda, Starch, etc.
1938—No. 217	THE FLEETWAY MANUFACTURING CO. LTD., Winton House, St. Andrew Street, London, E.C.4; Wringing Machines, Carpet Sweepers, etc.
1938—No. 218	THE GRAMOPHONE CO. LTD., Hayes, Middlesex; Wireless Apparatus, Electrical Appliances, etc. (*Applicable also to traffic consigned by three Associated or Subsidiary Companies.*)
1938—No. 219	EDWARD HILL & SONS LTD., Regina Works, Lye, near Stourbridge; Holloware.
1938—No. 220	PREMIER YEAST CO. LTD., Long Drive, Greenford, Middlesex; Yeast, etc.
1938—No. 221	SHEET IRON WORKERS LIMITED, Phoenix Works, Cradley, near Cradley Heath, Staffs; Telegraph Stay Rods and Brackets; Holloware, etc.
1938—No. 222	THOMAS & EVANS LIMITED, Porth, South Wales; Tea.
1938—No. 223	THOMAS & EVANS LIMITED, Porth, South Wales; Vinegar.
1938—No. 224	CHAIN LIBRARIES LIMITED, 28, City Road, London, E.C.1; Books; Stationery and Stationers' Sundries; Tobacco and Cigarettes.
1938—No. 225	THE CITY AND PROVINCIAL STORES LIMITED, Atlantic Mills, Droylsden Road, Newton Heath, Manchester, 10; Furniture and Household Requisites. (*Applicable also to traffic consigned by two Associated or Subsidiary Companies.*)
1938—No. 226	GEO. T. COX & SONS LTD., 31, King William Street, London, E.C.4; Groceries, Preserves, Provisions, etc.
1938—No. 227	THE DISTRIBUTORS AND TRANSPORTERS LIMITED (MESSRS. LEVER BROTHERS AND UNILEVERS LTD., DISTRIBUTING ORGANISATION), Unilever House, Blackfriars, London, E.C.4; Soap, Margarine, Lard Compound, etc., ex Liverpool and Birkenhead stations. (*Applicable to traffic consigned by thirteen Associated or Subsidiary Companies.*)
1938—No. 228	EVESON BROTHERS (1928) LTD., Monarch Works, Lye; Holloware, Electric Wash Boilers, etc.
1938—No. 229	FACCHINO'S PURITY BISCUITS LIMITED, Purity Works, Old Bromford Lane, Ward End, Birmingham, 8; Biscuits, etc. (*Applicable also to traffic consigned by one Associated or Subsidiary Company.*)
1938—No. 230	J. LOVELL & SON LTD., Avon Paper Mills, Linlithgow; Paper, etc.
1938—No. 231	MARS CONFECTIONS LIMITED, Trading Estate, Slough; Confectionery.
1938—No. 232	JOHN NOBLE LIMITED, Brook Street, Manchester, 1; Clothing, Drapery and General Stores Wares. (*Applicable also to traffic consigned by one Associated or Subsidiary Company.*)
1938—No. 233	THE SHAW FOUNDRY CO. LTD., Willenhall, Staffs; Castings, Hardware, Mattresses, Bedstead Fittings, etc.
1938—No. 234	THE STANDARD YEAST CO. LTD., Lamb Distillery, Church Street, Chiswick, London, W.4; Yeast and Bakers' Sundries. (*Applicable also to traffic consigned by one Associated or Subsidiary Company.*)
1938—No. 235	STAR SHIRT (1926) CO. LTD., 31, 33 and 39, Sefton Street, Liverpool; Cotton and Linen Goods.
1938—No. 236	THOMSON & CHARNOCK LIMITED, 16 to 20, Stanley Road, Liverpool, 5; Poultry Food, etc.
1938—No. 237	WORLDWIDE WHOLESALE WAREHOUSES, Charles Street, Manchester, 1; Furniture and Household Requisites.
1938—No. 238	JOHN HENRY BISHOP, Haverfordwest; Rabbits (dead).
1938—No. 239	H. GRAHAM & CO. LTD., Elsley House, 24-30, Great Tichfield Street, London, W.1; Ladies' Coats, Costumes and Dresses.
1938—No. 240	R. TWINING & CO. LTD., 216, Strand, London, W.C.2; Tea, Coffee and Cocoa.
1938—No. 241	WILLIAMS & PHILLIPS, 9, Burgess Street, Liverpool, 3; Sausages, etc.
1938—No. 242	YOUNG & ROCHESTER LIMITED, 2 and 3, Love Lane, Wood Street, London, E.C.2; Shirts and Collars.
1938—No. 243	J. DARNELL & SON LTD., 76 to 94, Kingsland Road, London, E.2; Boots and Shoes.
1938—No. 244	LISTER & CO. LTD., Attleborough Mills, Nuneaton; Mats, Rugs and Table Covers.
1938—No. 245	THE STANDARD YEAST CO. LTD., Lamb Distillery, Church Street, Chiswick, London, W.4; Yeast and Bakers' Sundries. (*Applicable also to traffic consigned by one Associated or Subsidiary Company.*)
1938—No. 246	SWEARS & WELLS LIMITED, Britannia House, 16/17, Old Bailey, London, E.C.4; Furs, Gowns and Mantles. (*Applicable also to traffic consigned by three Associated or Subsidiary Companies.*)
1938—No. 247	WASDELL LIMITED, Holdford Road Works, Witton, Birmingham, 6; Motor Car and Motor Cycle Wings, etc.
1938—No. 248	WILKINSON & WARBURTON LIMITED, Caressa House, King Street, Leeds, 1; Clothing and Textiles.
1938—No. 249	ACHILLE SERRE LIMITED, Blackhorse Lane, Walthamstow, London, E.17; Dyed and Cleaned Goods, Tricycle Carriers, Tyres, etc. (*Applicable also to traffic consigned by one Associated or Subsidiary Company.*)
1938—No. 250	THE BRITISH BROADCASTING CORPORATION, Broadcasting House, Portland Place, London, W.1; Periodicals, etc.
1938—No. 251	CARRICKS (CATERERS) LIMITED, 47, Grey Street, Newcastle-upon-Tyne, 1; Cooked Meats, Cream Cheese, Fish and Meat Pastes, etc.
1938—No. 252	STEAD & SIMPSON LIMITED, Belgrave Gate, Leicester; Boots and Shoes.
1938—No. 253	J. W. MYERS LIMITED, Saville Street Works, Saville Street, Leeds, 1; Caps and Clothing. (*Applicable also to traffic consigned by one Associated or Subsidiary Company.*)
1938—No. 254	The CALOR-GAS (DISTRIBUTING) CO. LTD., Belgrave House, Belgrave Street, Euston Road, London, W.C.1; Butane Gas.
1938—No. 255	THE "SUN" CYCLE & FITTINGS CO. LTD., Aston Brook Street, Birmingham, 6; Bicycles, Fittings and Accessories, etc.
1938—No. 256	R. T. JENNINGS & SON LTD., Marsh Street, Stafford; Boots and Shoes.
1938—No. 257	FARMA CREAM PRODUCT CO. LTD., 23/25, Prince of Wales Crescent, London, N.W.1; Butter, Cream, Milk Powder and Condensed Milk.
1938—No. 258	HORLICKS LIMITED, Slough; Malted Milk, etc.
1938—No. 259	WITCHAMPTON BY-PRODUCTS LIMITED, Riverside Works, Weybridge; Firelighters.
1938—No. 260	THE IOCO RUBBER & WATERPROOFING CO. LTD., Netherton Works, Anniesland, Glasgow, W.3; Cotton Goods, India Rubber Goods, Waterproof Clothing, Paper, etc.
1938—No. 261	WIGGINS, TEAPE & ALEX PIRIE (SALES) LIMITED, 46/58, Mansell Street, Aldgate, London, E.1; Paper ex Chartham. (*Applicable to traffic consigned by one Associated or Subsidiary Company.*)
1938—No. 262	THE NATURAL FOOD CO. LTD., 210, 212, 214, Cambridge Road, London, E.2; "Allinson Flour," etc., ex Newport.
1938—No. 263	THE NATURAL FOOD CO. LTD., 210, 212, 214, Cambridge Road, London, E.2; "Allinson Flour," Breakfast Oats, etc., ex Castleford.
1938—No. 264	HIPPS (1931) LIMITED, Hipsley Works, Grace Street, Leeds, 1; Clothing.
1938—No. 265	HARVEY, BROWN & CO. LTD., Rexoleum Works, Alperton, Wembley; Floor Covering (Bitumen), Wooden Rollers, etc.
1938—No. 266	THE "Z" FURNISHINGS COMPANY, 41, Grainger Street, Newcastle-on-Tyne, 1; Folding Tables.

Legal and Official Notices—*continued*

Number of Application	Name of Trader and General Description of Traffic
1938—No. 267	VITACREAM LIMITED, 48, Mark Lane, London, E.C.3; Butter Vitacream, etc.
1938—No. 268	J. SMITH HARGREAVES & CO. LTD., 8, New Brown Street, Manchester; Towelling and Shirting. (*Applicable also to traffic consigned by one Associated or Subsidiary Company.*)
1938—No. 269	TURNER & SON LTD., Goldsmith Street, Nottingham; Cake.
1938—No. 270	T. WALL & SONS LTD., The Friary, Acton, London, W.3; Sausages, Cooked Meat, Lard, etc.
1938—No. 271	GREENGATE & IRWELL RUBBER CO. LTD., Irwell Works, Ordsall Lane, Salford, Manchester; Waterproof and Showerproof Coats, Light Electrical Cable, Belting, Rubber Goods, Gaiters, Leggings, Slippers, Ebonite Sheets and Cylinders.
1938—No. 272	RICHARD RICHMOND LIMITED, Caddaw Avenue, Hucknall; Hosiery.
1938—No. 273	AUSTIN REED LIMITED, Summit House, Red Lion Square, London, W.C.1; Articles for sale or use at the Trader's Branch Shops and Returned Articles, etc.

Amenities of Railway Passenger Travel

Sir Harold Hartley, Vice-President, Works and Ancillary Undertakings, and Director of Scientific Research, L.M.S.R., read a paper to the Institute of Transport on Monday on "Amenities of Railway Passenger Travel." These amenities he classified under five headings, dealing first with the elimination of vibration or irregular motion.

Vibration or irregular motion arose from three sources; motion of the wheel on the rail; springing and coupling of vehicles; and effect of the permanent way. The normal procedure of coning wheel tyres was presumably to produce a centring action, and also to facilitate the movement of wheels round curves with the minimum of slip. But the centring effect referred to took the form of a transverse motion of the axle, which might proceed too far and produce a return reaction. This set up the violent transverse oscillation known as bogie hunting. The motion of a coned wheel on straight track had recently been studied theoretically and experimentally by Professor C. E. Inglis and Dr. R. D. Davis in the Cambridge University Engineering Department, and their findings would shortly be communicated to the Institution of Civil Engineers. Their theory suggested that cylindrical tyres should give complete immunity from lateral oscillation and hunting, and it had been endorsed by the experience of the Chicago Milwaukee & North Shore system, where cylindrical tyres had been fitted to high-speed trains, giving very smooth riding without rapid loss of this quality as the treads became hollow through wear. Cylindrical tyres had also been applied to the trailing axles of the Burlington Zephyr trains which at first oscillated considerably, and smooth riding was now obtained even at speeds of 100 m.p.h.

A similar effect had been found with the cylindrical tyres, fitted after experiments with different conings, to the L.M.S.R. Coronation Scot, the record run of November 16, 1936, having been made with such wheels. But it had been found that excessive flange wear necessitated turning the wheels after 20,000 miles on the fast London—Glasgow service, so the company had adopted a compromise of 1 in 100 coning, which gave almost as good riding without the disadvantage of excessive flange wear.

Other factors contributing to smooth riding were the braking and springing of vehicles, and the permanent way itself. Sir Harold Hartley mentioned the use of the Cambridge accelerometer to ascertain the transverse and vertical accelerations of a vehicle in motion. High speeds had also set new problems for the permanent way engineer, in the directions of ensuring smooth riding, relaxing speed restrictions, and avoiding the increased maintenance costs arising from the increased tendency of vehicle wheels at high speeds to destroy alignment and cause more wear of the rail. The engineer met these conditions with the aid of the Hallade recorder, which showed where irregularities were present (see THE RAILWAY GAZETTE of October 8, 1937), and by the adoption of measured shovel packing to maintain a true top to the track (THE RAILWAY GAZETTE, July 9, 1937). As a result of tests with the Hallade recorder, 269 curves had been re-aligned on the L.M.S.R. in preparation for the Coronation Scot high-speed service.

As regards the relaxation of speed restrictions at junctions, where in the past it had been customary if the lines were of equal importance, to lay both on the level, Sir Harold Hartley said that 32 junctions between Euston and Glasgow had been relaid with two-level chairs permitting a level straight road but a canted curve (see THE RAILWAY GAZETTE of October 2 and 9, 1936).

Rail joints were a further maintenance problem, and investigation had shown that the vertical accelerations of wheels at a joint might be equivalent to an increase in axle load of 200 per cent. Even greater vertical accelerations might be obtained in a wheel moving along a continuous length of rail owing to the rise and fall as it passed over a sleeper. These large accelerations had been found to occur when the speed was such that the number of sleepers traversed per second synchronised with the natural frequency of vertical oscillations of the track. Sir Harold Hartley also referred to the welding of rail joints to reduce their number, in discussing the second amenity on his list—reduction of noise level. Many sources of noise were accentuated by bad riding, and consequently curable by the measures already mentioned. By reducing vibration of fittings, and the transmission of noise from outside the vehicles by the use of thicker glass in windows and other insulating methods, the noise level in a London tube car passing through a tunnel with welded rails and sprayed walls had been reduced to 65 phons from 76 phons in a standard car with windows closed in a normal tube tunnel (the noise level of busy road traffic is about 80 phons).

As his third amenity, Sir Harold Hartley classed heating and ventilation. With reference to air-conditioning, he mentioned that 11,000 passenger cars had been so treated in the U.S.A. The cost of the equipment varied from £800 to £1,500 a car, and it weighed about five tons. A recent questionnaire on air-conditioning circulated to 5,000 passengers in the U.S.A. had produced only a small proportion of unfavourable views. Fifty per cent. of the complaints said "slightly too warm," "slightly too cold," or "much heat from sun," in about equal proportions.

Although complete air-conditioning was not justified in the British climate, two proprietary systems were in use for providing ventilation without admitting noise and dirt. The dirt liable to enter through ordinary open windows and ventilators proceeded about equally from the locomotive and from the ballast. Sliding ventilators were now in use, however, that extracted air at speeds up to 610 ft. per min. at 3 in. from their leading edge in a train travelling at 65 m.p.h., compared with 2,000 ft. per min. inrush of air through an ordinary drop window open 3 in.

The speaker concluded by referring to lighting, and general amenities, remarking upon the fact that 13,746 coaches had been built for British railways in the last ten years, all with electric lighting. Chief in his list of general amenities he placed comfortable seating, for, he said, it was the actual comfort of the seat that did more than anything to determine the passengers' satisfaction.

NOTES AND NEWS

Leeds Stations.—Leeds Wellington and Leeds New stations will be combined on and from May 2 and will be known as Leeds City station.

New G.W.R. Halt for Carreghofa.—A new halt at Carreghofa between Llanymynech and Llansantffraid was opened by the G.W.R. on Monday, April 11.

L.M.S.R. Stations Closed.—Lea Road, and Salwick stations on the Preston-Blackpool line of the L.M.S.R. will be closed for passenger traffic from May 2.

Derailment near Bedford, L.M.S.R.—Early on March 27 an express goods train from Nottingham was derailed near Bedford, L.M.S.R. Traffic was resumed on the fast lines at noon, but the slow lines remained obstructed for some time longer.

L.M.S.R. Manchester Goods Manager's Office Dinner.—The annual dinner of the L.M.S.R. Commercial Department, District Goods Manager's Office, Manchester, was held at the Midland Hotel, Manchester, on March 28. Mr. H. G. Humphreys, District Goods Manager, presided. Co . Sir Joseph Nall replied to the toast of "The Guests," proposed by Mr. Humphreys. The toast of the L.M.S.R. was proposed by Mr. Forrest Hewit, Managing Director of the Calico Printers' Association and Chairman of the Joint Committee of the Cotton Trade Associations. Mr. Ashton Davies, Chief Commercial Manager, L.M.S.R., responded. Some 200 of the leading business men of Manchester, Salford, and district attended the function.

Goods Train Collision on L.M.S.R.—Late on March 25 two goods trains collided at Whitacre junction, between Birmingham and Tamworth on the Derby—West of England main line, L.M.S.R., blocking all lines. Buses were used to convey passengers meantime.

Centenary of the Atlantic Ferry.—To celebrate the centenary of the departure of the ss. *Great Western* on her maiden crossing of the Atlantic, the Lord Mayor of Bristol and the Port of Bristol Authority invited a distinguished company of shipping and commercial representatives from all parts of the country to a ceremony at Bristol on Friday, April 8. Last week we outlined in an editorial article the circumstances attending the establishment of the first regular transatlantic steamship service. At the ceremony a congratulatory telegram was received from the Mayor of New York. The Lord Mayor of Bristol, in proposing the toast of "The Guests," said that while they did not claim that the *Great Western* was the first steamship to cross the Atlantic, the idea of a transatlantic steam service belonged to Bristol; it was there that the *Great Western* was built; and thence she sailed for New York. Sir Percy Bates, Chairman of the Cunard-White Star Line, responded, and added that it was but an accident that the original Bristol pioneers were not running the *Queen Mary* today.

Southern Railway A.R.P. Training.—The Southern Railway has already enrolled over 10,000 volunteers for Air Raid Precautions training, and on April 1 a demonstration of their work was given at Brunswick House, Vauxhall. The General Manager, Mr. Gilbert S. Szlumper; the Assistant General Manager, Mr. J. B. Elliott; and the Traffic Manager, Mr. E. J. Missenden; attended the demonstration, after which Mr. Szlumper and Mr. Elliott themselves passed through the gas chamber. As recorded in our issue of April 1, Mr. G. Wynne Davies has recently been appointed General Purposes Officer, with responsibility for the control and co-ordination of A.R.P. work throughout the Southern Railway.

CONTRACTS AND TENDERS

The Egyptian State Railways Administration has placed orders for copper wire based on the assumed price of £45 per ton. (Ref. No. E.S.R. 30.406) :—

Osnabrucker Kupfer : 50,000 kg., total price £2,517, delivered f.o.b. Bremen).

British Insulated Cables Limited : 50,000 kg., total price £2,562, delivered f.o.b. Liverpool or Birkenhead.

P. & W. MacLellan Limited has received an order from the Egyptian State Railways Administration for mild steel plates (Ref. No. E.S.R. 1.412, total cost £250, delivery free Gabbary Quay, Alexandria).

Taylor Bros. & Co. Ltd. has received an order from the Buenos Ayres Western Railway for 40 pairs of carriage and wagon wheels and axles.

The United Flexible Metallic Tubing Co. Ltd. has received orders from the Egyptian State Railways Administration for the supply of flexible metallic tubes (Order No. 17,209, total price £466, f.o.b. London).

Usines & Aciéries Allard has received an order from the Egyptian State Railways Administration for the supply of axleboxes (Order No. 21.756, total price £224, f.o.b. Antwerp).

The Clyde Rubber Works Co. Ltd. has received orders from the Egyptian State Railways Administration for the supply of india-rubber drawbar springs (Ref. No. E.S.R. 21.780, total price £1,233 delivery f.o.b. Glasgow).

Dorman, Long & Co. Ltd. has received an order from the Central Argentine Railway for 4,500 pairs of steel fishplates, for 85-lb. rails.

The Bengal–Nagpur Railway Administration has placed the following orders :—

Peter Brotherhood Limited : Two spare crankshafts for air compressor.

W. G. Bagnall Limited : Locomotive motion details.

Henry Pels & Co. Ltd. : Shearing blades for bar and billet shearing machine.

Thos. Hinshelwood & Co. Ltd. has received an order from the Egyptian State Railways Administration for 10 tons of paint (Ref. No. E.S.R. 60.308, item 2, price £429, delivered f.o.b. Antwerp.)

Jessop & Co. Ltd. has received orders from the Indian Stores Department, for 171 cwt. of fishbolts and 1,216 cwt. of dogspikes.

Tenders are invited by the Bombay, Baroda & Central India Railway, receivable by April 29, at The White Mansion, 91, Petty France, Westminster, S.W.1, for the supply of bolts, nuts, and rivets.

Tenders are invited by the Egyptian State Railways Administration, receivable by May 14, at the General Management, Cairo, for the supply of approximately 1,370 metric tons of rolling stock oils.

Tenders are invited by the Egyptian State Railways Administration, receivable by April 30, at the General Management, Cairo, for the supply of 50 metric tons cadmium copper wire and 15 metric tons phosphor bronze wire.

Tenders are invited by the Egyptian State Railways Administration, receivable by April 23, at the office of the Superintendent of Stores, Saptieh, Cairo, for the supply of 470 No. 6, 900 No. 7, and 200 No. 9 lubricating pads.

Tenders are invited by the Egyptian State Railways Administration, receivable by May 10, at the Stores Department, Saptieh, Cairo, for the supply of 7,475 ft. of 6-in. cast or spun iron water piping.

The New Zealand Public Works Department is calling for tenders for the supply and delivery of two two-ton portable, petrol-electric or diesel-electric self-propelling cranes. Tenders endorsed "Quotation for crane units," should be addressed to the Secretary, Public Works Tenders Board, Wellington, C.1, New Zealand, to be received by June 28, 1938. A copy of the specification and general conditions of tender may be borrowed from the Department of Overseas Trade, London, S.W.1. Local representation is desirable.

In view of the Easter holidays, this issue of THE RAILWAY GAZETTE *is published three days earlier than usual, and consequently the tables of British and foreign railway traffic returns are held over until next week*

Diesel Railway Traction

Philandering

IT was a happy thought which prompted Mr. W. A. Stanier to use this word, during the discussion on the recent paper by M. Dumas before the Institution of Locomotive Engineers, when referring to the acquisition of a three-car diesel train by the L.M.S.R. (described elsewhere in this issue). So exactly did it describe English efforts with railcars that it became almost a catchword at the meeting, and all that need be asked is—who is holding up the application of one of the most successful traffic units ever evolved? To judge by the discussion at the Institution of Locomotive Engineers' meeting the traffic departments are the culprits. It is true that the Great Western Railway, alone among the four big English systems, has made an organised effort to take advantage of the possibilities of railcars, but it has taken over two years and a rapidly-rising operating cost of the whole railway to show that if only supplementary services are to be worked by diesel cars there will be little, if any, gain in net revenue. The present intention, as mentioned by Viscount Horne at the last annual general meeting of the Great Western Railway, is to replace steam trains by the diesel cars, and if supplementary railcar services are then run as required, or practically the entire timetable for a given section of line recast to reap benefit from the characteristics of the railcar, then it is good, sound railroading, and we have made a step forward from—philandering.

Repairs and their Organisation

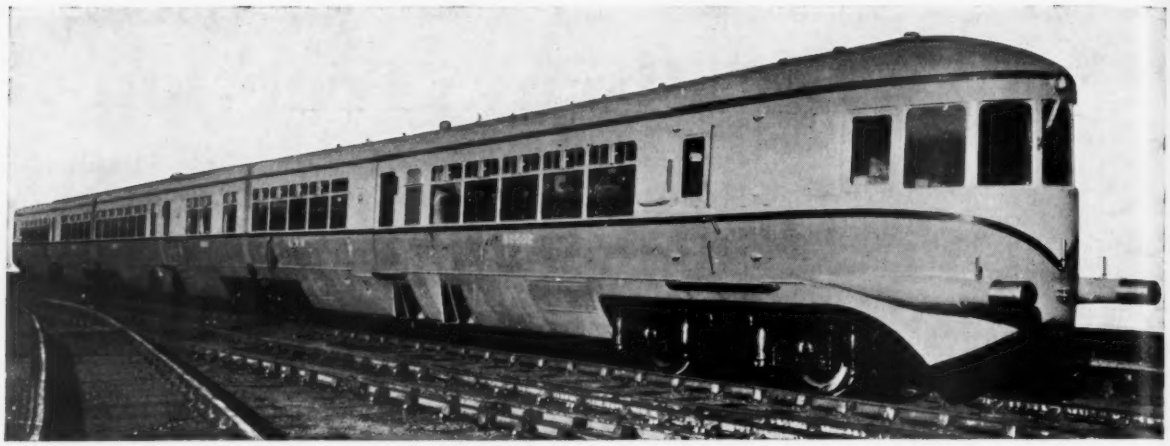
IF full benefit is to be reaped from railcars it does not do to keep them idling in depots or shops half their time, either waiting for spare parts or being given an overhaul at such times as few steam locomotives are in. As maintenance and repair charges together form one of the principal factors in total operating cost, the annual mileage of the railcars should be high, and the periods of inaction for ordinary maintenance and periodic or general overhauls should be short. This presupposes a car of really good design, but as there are numbers of these suited to practically any given duty, a high repair cost at the present day is simply an indication of an error in selection. Particularly when there are more than two or three cars in service, the principles applied freely to the maintenance of steam locomotives should be adopted for the best all-round results, that is, the railcar depots and repair shops should be well equipped and organised to get results, and a reasonably big stock of spare parts kept in hand, so that by a replacement the car can go back into traffic almost at once, and, if necessary, the faulty constituent repaired at leisure. If the use of a good many cars leads to certain initial expense in the building and equipment of special sheds and shops, the effect on the cost per mile is not great, and if operation on certain sections is entirely, or very largely, by railcars, may be offset by reduced maintenance of permanent way and in the lesser upkeep cost of stations and bridges. On the French National Railways, where railcar operation has always been tackled in a workmanlike manner designed to produce results which will be felt by the railway as a whole several up-to-date repair plants are in existence, such as those at Rennes (ex-Etat), La Chapelle (ex-Nord), and Noisy-le-Sec (ex-Est). On the Italian State Railways heavy repairs are concentrated mainly at Florence, but in Germany a regional system of heavy repairs has been adopted on the Reichsbahn.

In the case of the German State Railway it will be appreciated that not the least of the problems connected with the operation of 18 high-speed trains, 350 railcars, and about 40 petrol cars is the organisation of maintenance and repair. At the moment, repairs are carried out at seven centres, viz., Königsberg, Wittenberge, Dessau, Kassel, Opladen, Nüremberg and Friedrichshafen. The Königsberg depot looks after the cars in that part of Germany beyond the Polish corridor; Wittenberge deals with all the high-speed trains and the cars from the Altona, Schwerin, Stettin, Berlin, and Hanover districts; Dessau those from the Dresden, Osten, Breslau, and Erfurt districts; Kassel those from the Mainz, Frankfort, and Kassel districts; Opladen those from the Cologne, Essen, and Munster districts; Nüremberg those from the Munich, Regensburg, Augsburg, and Nüremberg divisions; and Friedrichshafen those from the Stuttgart, Karlsruhe, and Saarbrücken divisions. Normally, the standard 150 b.h.p. car with M.A.N. engine and Mylius mechanical transmission runs 93,000 miles between heavy repairs; the double bogie cars, by reason of the large number of engine makes and the variety of transmissions and auxiliary fittings, do not run so far between shoppings if the average is taken over the whole stud, but many of these vehicles do run 90,000 miles between repairs.

Maintenance in America has developed along somewhat different lines, owing mainly to the relatively tremendous distances covered by many of the streamlined diesel trains. In some cases trained mechanics accompany the train and carry out certain maintenance work *en route*, and then at the terminal point supervise other mechanics during the lay-over period. On the Santa Fe, the train is thoroughly inspected after every return trip, that is, after about 4,500 miles. The Union Pacific Railroad has selected the West Alameda, Cal., shops for the repair and maintenance of its Chicago—Pacific Coast diesel trains, and during the lay-over period of 29 hr. in California all the inspection and repairs must be done. On this line, as well as on the Burlington's Denver Zephyr service, it is not unusual for mechanics to complete certain maintenance and repair work during the first stage of the train's journey, if the lay-over period has been too short for all work to be done, and this is possible because of the multi-engine power installation.

TRIPLE-CAR DIESEL TRAIN FOR THE L.M.S.R.

Multi-engine design for miscellaneous services



750-b.h.p. diesel-hydraulic train for solo operation

A THREE-CAR diesel-hydraulic train with multiple-unit control has been built by the L.M.S.R. at its Derby works, and is to go into passenger service first on the 77-mile cross-country line between Oxford and Cambridge, *via* Bicester, Bletchley, Bedford, and Sandy. The principal characteristic of this train is that for a power of 750 b.h.p. it has no fewer than six engines and transmission sets. The three cars are articulated into one unit, and to enable the length of each car to be up to the maximum permitted by the locking bars without the *versed sine* of the body on sharp curves exceeding the usual limits, a special form of articulation has been adopted.

Power and Transmission

A new engine model for railcar work has been developed by Leyland Motors Limited, and is used for the first time in this L.M.S.R. train. Within six 4½ in. by 5½ in. cylinders and a piston-swept volume of 8·6 litres it produces an output of 125 b.h.p. at the maximum governed speed of 2,200 r.p.m., the piston speed being 2,020 ft. per min. and the brake m.e.p. 85½ lb. per sq. in. The previous type of Leyland railcar engine developed 130 b.h.p. at 2,000 r.p.m. within a piston-swept volume of 10 litres, and contrasted with the direct injection of this model, the present engine incorporates a newer form of air-cell combustion chamber. The crankcase is a single-piece aluminium-alloy casting, and carries the fuel filter water pump and drive, &c. A six-ram C.A.V.-Bosch injection pump is fitted.

Six sets of Leyland (Lysholm-Smith) hydraulic transmission are incorporated, and are mounted along with the engines and practically all the equipment, below the car floors. There are two power-transmission sets to each vehicle and they drive separate axles, so that all the axles

Arrangement of engine and radiator within the girder underframe

except the two end ones are driven. Because of the multi-engine installation it was necessary to incorporate a free-wheel in each transmission set so that the train can over-run the engines either with the converter in operation or with direct drive.

The final drives and reverse gearboxes on the axles have a ratio of 3·12:1, and this gives a top speed of 75 m.p.h. with normal maximum engine revs. These gears are of the double reduction type in which the bevel pinion engages with two crown wheels, either of which can be engaged with a sliding spur pinion to give a change of direction of motion. This change of direction is effected by compressed air electrically controlled from the control panels.

The radiators are mounted at each side under the floor in ducts which direct a flow of air from one side of the vehicle to the other; being approximately to an S form, these ducts provide a current of air through the radiators whatever the direction of motion. Each radiator combines cooling elements for the engine jacket water, converter fluid, and engine lubricating oil.

Compressed air for engine control and brakes is obtained from three engine-driven, one transmission-driven, and two electrically-driven Westinghouse compressors. The engine-driven compressors are direct-coupled by Texropes to one engine on each underframe; the transmission-driven compressor is mounted on the propeller shaft of one engine on the centre underframe. Two dynamos, supplying current for engine and door controls and for electric lighting, are of a light type and are driven by Texropes from the propeller shafts.

Engine Control

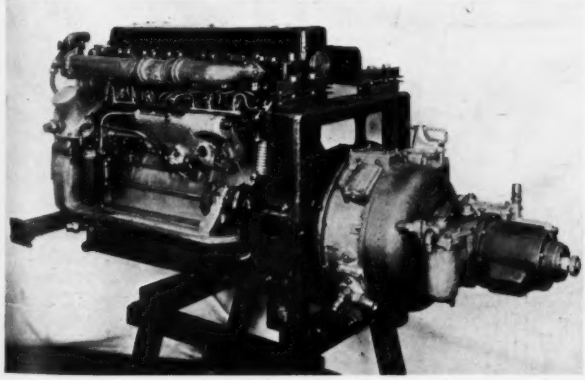
Control of the engines and transmission sets is effected by the Westinghouse-Leyland pneumatic system. The control panel in each driving compartment is fitted with (*a*) self-lapping throttle control valve; (*b*) torque converter switch giving neutral, converter drive, and direct drive; (*c*) reversing switch; (*d*) six red lights to indicate failure of oil pressure in any of the six engines; (*e*) six engine starter buttons; (*f*) three glow-plug switches and indicator lights; (*g*) electrical compressor switch and indicator lights; (*h*) speedometer; (*i*) duplex air pressure gauge for brakes; (*j*) air pressure gauge for throttle control pipe; (*k*) light to indicate when sliding doors are closed.

The self-lapping throttle control valve (*a*) controls the pressure in a through train pipe. Each fuel injection pump is controlled by a small air cylinder on each engine, acting in response to variations in pressure produced in the train pipe by the movement of the valve on the panel. In the event of oil failure or low water level on any engine, a valve comes into operation and cuts off the air supply to the air cylinder controlling the particular fuel injection pump without affecting the remainder. This stops the engine concerned. Owing to the free wheel in the drive, any engine which cuts out is automatically free from the train. In order to keep the engines at idling speed it is necessary to maintain a pressure of approximately 30 lb. per sq. in. in the throttle control pipe. To avoid accidentally shutting off the engines the throttle control valve is provided with a stop so that the handle can only be moved to the engine-off position by lifting a catch.

A deadman pedal is provided in each driving cab and is so connected that if pressure is released from the pedal the brakes are automatically applied, and the air in the throttle control pipe is exhausted down to a pressure of 30 lb. per sq. in., thus reducing the engines to idling speed. An interlocking circuit operated by the passenger sliding doors similarly prevents the throttle control pressure from being increased above 30 lb. while any passenger door is open.

Engine starting from the driving control panel is effected electrically. When each individual starter button is pressed, the starter on the corresponding engine engages, and when normal idling speed is reached it is automatically thrown out of engagement and will not re-engage whilst the engine is running. During starter operation, maximum oil injection is automatically maintained on that particular engine for starting purposes.

The three positions of the torque converter clutches are given by a double-acting compressed air cylinder, under the control of two electro-pneumatic valves and a rotary contactor which cuts off the supply of air and current when the desired position is obtained. Similarly, the direction of motion of each driving axle is obtained by another double-acting air cylinder, electro-pneumatic valve, and contactor. Owing to an electric interlock with the torque converter drive a change of direction of motion can only be made when the torque converter is in the neutral position. When changing the direction of motion a lamp lights in the driving compartment and remains alight until all gears are engaged in the same direction. Each engine can be controlled from its own individual local panel, the object of which is to enable engines to be started and warmed up or examined individually.

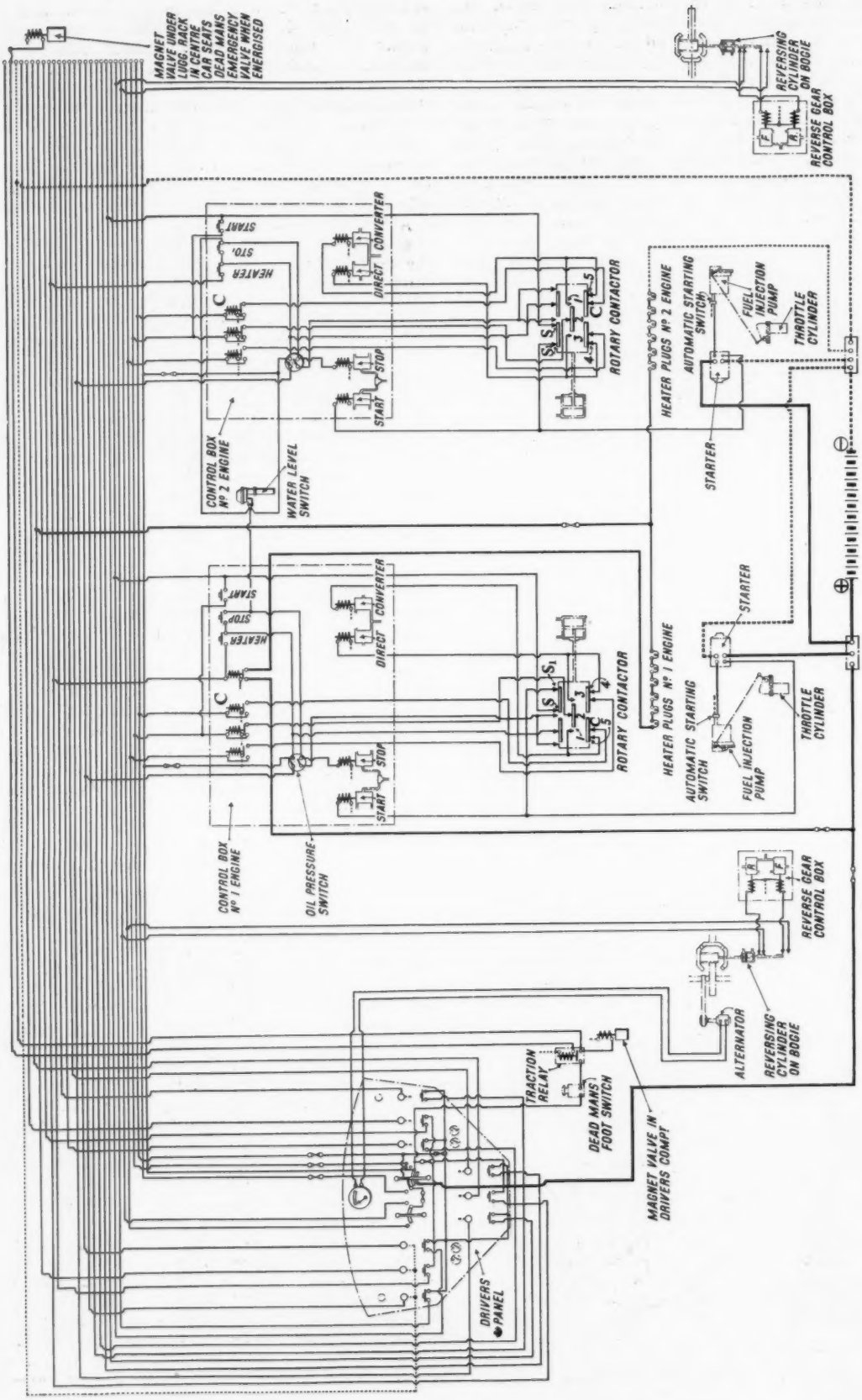


125-*b.h.p. six-cylinder Leyland engine and Lysholm-Smith type of hydraulic torque converter*

Transmission Control

The control switches (*b*) and (*c*) for the torque converter and reversing control are used to energise the solenoid valves through suitable relays, which control the admission of air to the double-acting air cylinders on the torque converter and final drive gearbox. The switch comprises a gunmetal frame carrying a Bakelite fabric base with spring loaded contact buttons. Two spring-loaded plungers engage with the drum, giving three definite positions for the switch. Through one of these plungers on each drum is carried the positive feed to the switch contacts. A mechanical locking device is incorporated between the two drums, to ensure that the reversing switch is only operative when the converter switch is in the neutral position. The switch is attached to the underside of the control panel, the levers projecting through slots.

The handle of the torque converter switch is removable in the neutral position only, and must be inserted in its socket to enable the converter, reversing, and starting controls to be operated, and to bring the positive feed to the oil pressure switches. The handle of the reversing switch is also removable in the neutral position only. It is necessary to remove all reversing and converter handles from their switch sockets in the non-driving



Wiring diagram of electro-pneumatic control system, L.M.S.R. diesel-hydraulic train

panels, otherwise control at the operative panel is obstructed.

The starting and reversing circuits are completed only when the converter control switch is in the neutral position, and the starting circuit is further interlocked by being carried through the rotary contactor, operated by the converter clutch lever to prevent starter engagement unless the transmission is actually in the neutral setting. To stop an engine it is only necessary to return the throttle lever to the zero position.

A double-acting air cylinder is provided for operation of the torque converter clutch, but provision is made for manual operation of the clutch mechanism in the event of failure of the air pressure cylinder, or insufficient reservoir pressure.

Air pressure does not require to be constantly applied to the clutch cylinder, as a spring detent is provided to retain the piston in the neutral position when the pneumatic effort has placed it there. Nor is pneumatic effort required to hold the clutch in either the direct drive or converter drive settings; in these positions the clutch facings are held in engagement by the toggle action of the clutch springs which follow up wear automatically.

A drum switch, described as the rotary contactor, is provided to cut off current from the magnet valves and so place both sides of the piston in communication with the atmosphere when one of the three positions is attained. A double-acting air cylinder is mounted directly on the final drive gearbox and provided with adaptors for flexible pipe connection to the frame. A manual shifting device is provided, in the event of failure of the air pressure.

Two special switches are fitted to the reversing cylinders to ensure that these are kept charged with air while the transmission is in the neutral or converter setting, and until the piston is about $\frac{1}{8}$ in. to $\frac{1}{16}$ in. from the end of its travel, when the air is cut off from the cylinder.

Two types of magnet valves are used, one for the clutch and reversing cylinders and for the admission of full reservoir pressure to the throttle cylinder in starting, and the other for reducing the throttle cylinder to atmospheric pressure for stopping the engine. In the first type the supply port is coupled to the cylinder port when the coil is energised. In the second type the cylinder port is coupled to the atmospheric port when the coil is energised.

Each double-acting cylinder is controlled by two magnet valves, which can only be energised alternatively. The consumption per valve is 0·15 amp. at 24 volts. There are three train wires associated with the converter control, each fed in one of the three positions of the switch and each feeding in turn a separate solenoid relay. When any one of these three relays is energised, contacts are closed in opposition to springs, completing the circuit from the battery positive up to the appropriate contact on the rotary contactor, which unit performs the final stage in the converter control. These relays are wound to withstand continuous service with low current consumption.

The rotary contactor is mounted in the torque converter clutch housing, and comprises a small cam-operated switch with the cam mechanically linked to the clutch control arm. The switch consists of a central cam spindle which operates on spring-loaded arms carrying platinum points, and contacting with fixed platinum points in such a manner as to make and break circuits originally closed or preselected at the panel in accordance with the movement of the clutch lever. The switch is housed in an aluminium casing.

Contacts *1*, *2*, and *3*, which are housed in the cover supporting the rotary contactor, are provided with adjustment which permits the platinum contact points to make or break circuit earlier or later as required. These contacts are used for finding the neutral position on the torque converter clutch operating lever, and permit a very fine adjustment to be made, thus preventing unnecessary hunting on the clutch operating lever. A pointer is fixed to the end of the cam spindle, and the base for the contacts (housed in the cover supporting the rotary contactor) has a raised portion with a line scribed on it. When the end of the pointer coincides with the scribed line, the electrical centre of the rotary contactor is found.

These circuits are those controlling the two magnet valves for the clutch cylinder, the starting motor, and the oil pressure switch, the contacts are so arranged that they give three positive positions of the clutch mechanism in accordance with the panel switch positions, and also break the feed to the magnet valves when the clutch is actually in either direct, converter, or neutral setting, thereby relieving the clutch ball race of load and preventing waste of air or electricity. When the neutral setting is selected on the converter control switch, the neutral relay is energised, thus connecting the battery positive with the contact *2*.

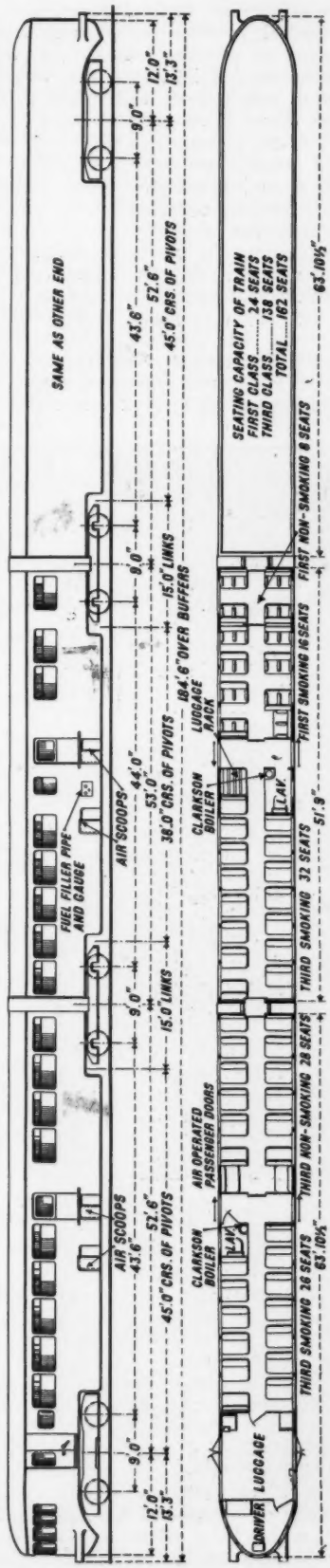


Diagram of 162-seater L.M.S.R. diesel train having a top speed of 75 m.p.h.

To understand how positively the control is held in the neutral position under these conditions, it is only necessary to consider that the bar is moved to the left by some outside influence; this would bring the middle segment into contact with point *1*, energising the converter drive valve and admitting air to the left hand side of the piston, with the effect of restoring the bar to its original position. A similar action would take place in conjunction with terminal *3*, if an external force should tend to cause movement to the right from the central setting.

Considering the bar in the neutral position, if the converter solenoid relay were energised, the battery positive would feed through *C* and *5* to the converter valve, causing the piston to move to the right-hand or converter end; some time before completion of the travel the point *5* would lose contact with its segment, de-energising the magnet valve and leaving the piston with atmospheric conditions on both sides; under these circumstances the

Driving position of L.M.S.R. train

toggle action of the clutch springs is sufficiently powerful to complete the motion.

The fourth contact piece is provided with contacts for completing the circuit for the starting motor when the rotary contactor is in the neutral position only. No circuit is obtainable when the contactor is in the converter or direct drive setting. The fifth contact piece is provided with contacts which interrupt the circuit to the oil pressure switch when the transmission is in the neutral setting.

The oil pressure switch operates to close contacts with a falling oil pressure at 6 lb. per sq. in. and to open contacts with a rising oil pressure at 8 lb. per sq. in. A falling pressure would result from engine stoppage, or from any defect in the lubrication system such as broken or leaky pipes, faulty pump, or lack of oil, or a fractured engine oil sump. It also occurs simply as the result of normal engine stoppage.

There are two independent circuits, one used to feed an oil pressure light on each panel, thus indicating the defective engine, the other used to energise the stop magnet valve, to stop the engine as the result of any oiling defect, providing such defect occurs when the transmission is in the direct or converter drive settings. The contacts are operated by expansion of a metallic bellows which is designed to withstand a pressure of 160 lb. per sq. in. A quick break is ensured by a permanent magnet. The contacting pressure is indicated on a visible scale, and can be adjusted by a large external knob which can be locked or sealed.

The oil pressure switch, double check valve, and all relays and magnet valves required for the control of the throttle and torque converter for each engine are mounted in a dust-proof casing mounted on the underframe. This box has a sheet metal cover retained by spring fasteners. Two 12-pin couplings having self-aligning contacts are provided to permit removal of the box without detaching any of the wires leading to or from the box. The connections are made clear by figures stamped on the coupling body. The two magnet valves for the control of the reversing gear for each final drive are mounted in another dustproof casing mounted on the underframe and near to the final drive gearbox, and this box also has a sheet metal cover retained by spring fasteners.

Tell-Tale Apparatus

The low-water switch has two mercury switch tubes which operate to close contacts when the water in the engine cooling system falls below a certain level as the result of prolonged boiling, or leaks in the radiator or piping. It operates in conjunction with two adjacent engines, and has two independent circuits, each used to energise the stop magnet valves to stop the nearest engine.

The actual contacts are formed by short wires sealed *in vacuo* in a glass tube containing a small quantity of mercury. The tubes are held in a metal casing mounted on a pivot and so arranged that when a float falls below a certain point the tubes are overbalanced and suddenly tilt over to an angle of 30 deg., causing the mercury to bridge the wires and energise the throttle isolating switch, stopping the engine. When the water is at the correct level the mercury tubes are held firmly at an angle of 30 deg. in the open circuit condition by the buoyancy of the float, this angle being sufficient to prevent car movement from affecting the action. The switch and float mechanism are fully enclosed in a self-contained assembly which is applied to one water reserve tank on each car mounted above the level of the cylinder head and coupled to the radiator.

Control of the throttle is effected by providing for each fuel injection pump a small air cylinder arranged to thrust against calibrated springs for the regulation of the fuel delivery in accordance with pressure in the train pipe regulated by a self-lapping valve in the driving compartment. The springs which tend to return the fuel control lever to a position of zero delivery have a differential rate, arranged so that a given pressure causes the control to move to the idling position, but further movement beyond this point involves a considerable increase in pressure.

The double check valve consists of a cylinder with a free piston. The cylinder is connected by pipes at either end to the stop and start magnet valves, and in the middle to the throttle response cylinder. When air is admitted through the start magnet valve, the piston is blown

over, sealing the opening to the stop magnet valve, and uncovering the opening to the throttle response cylinder. The reverse action takes place when air is admitted through the stop magnet valve. Due to the low pressure required to give idling position on the throttle response cylinder, the piston is spring-loaded for movement in this direction.

Engine Starting and Stopping

A special form of automatic starting switch has been evolved by C.A.V.-Bosch for application to this train; it is attached to the fuel pump and operated by the combined action which the throttle lever and the pump governor exert on the rack. The conditions for starting an engine from the control panel are:

(1) The engine must be practically stationary; (2) there must be sufficient air pressure in the main reservoir to enable the throttle response cylinder to operate to the full throttle position; (3) the transmission must be in the neutral setting.

The positive feed to each switch is taken from a neutral contact on the converter control switch, and is only live when the switch is in the neutral position.

The feeds from the switches are taken through contacts *S* and *S1* on the rotary contactors, to the start magnet valves. The magnet valves admit air from the main reservoir through the double check valves to the throttle response cylinders, which operate to move the fuel pump levers to the full throttle position, and close the fuel pump starting switches. Simultaneously, a feed from the start magnet valve energises the starting motor solenoid, engaging the starting motor, the circuit being completed through the fuel pump starting switch to the battery negative. The driver's throttle control valve must be set to give not less than idling speed of the engine, so that the engine will continue to run at a definite speed after starter engagement.

Since there is no oil pressure in respect of a stopped engine, the normal action of the oil pressure switch is prevented when starting by taking the feed to the oil pressure switch which energises the stop magnet valve through contacts on the rotary contactor which are broken when neutral is engaged, but closed in direct and converter drive. This means that defective oiling will not prevent the starting of an engine and it will continue to run while the transmission remains in neutral, but as soon as the converter is engaged prior to moving the train, the oil pressure switch will cause the stop magnet valve to operate to stop the engine.

The starter button is not to be held down for a prolonged period after the starter has disengaged, otherwise the engine will be racing unnecessarily on the governor of the fuel pump. With the driver's throttle control valve set to give idling speed on the engine, the engines come to the idling speed when the starter button is released.

To obviate the necessity of having long or repeated starter engagements, due to difficulty in starting the engines on a cold morning, heater plugs are fitted to each engine. The heater plugs for two adjacent engines are connected in series, the battery positive to the heaters being carried through a relay in one of the adjacent control boxes. This relay is fed from a push-button switch on the control panel. In the event of the engines being started locally from the control box, a heater push-button switch is provided in the control box, housing the heater relay, which when pressed closes the relay and completes the heater circuit.

Spraying the interior of the L.M.S.R. diesel train with Roberts's asbestos insulation

For examination and inspection purposes, it is sometimes necessary to be able to start an engine locally. To enable this to be done a push-button switch is installed in the control box. If there is full pressure in the main reservoir, it is only necessary to press this switch, and, providing the transmission is in the neutral setting, the engine starts. For use if the pressure is low in the main reservoir, a mechanical linkage is provided on engines Nos. 2, 4, and 5, to enable the fuel pump lever to be moved into the full throttle position, thus closing the contacts in the fuel pump starting switch. After starting under these conditions, engines Nos. 2, 4, and 5 should be run until full pressure is registered in the main reservoir, when the other engines may be started as described above. In preparing the train for service in the morning each engine is started from cold by using these local controls; in this way the driver can listen to the running of each engine and observe the action of the various component parts in the control box.

A push-button switch is provided in each control box for stopping individual engines. This switch energises the stop magnet valve and brings the engine to rest. Where it is desired to isolate the engine out of action, stop cocks are provided on the control box to enable the pneumatic apparatus to be isolated from the main reservoir.

On each driving panel are fitted six indicator lights for low oil pressure, and three indicator lights for the heaters. The oil indicator lights glow as the result of the closing of the oil pressure switches. In starting up the engine, the converter control switch handle is first put into its socket in the panel, automatically energising the neutral and positive feeds and causing the oil indicator lights to glow at both panels. Upon starting the engines the indicator lights go out. If any light continues to glow after a reasonable number of starter engagements of that engine, the faulty unit is locked out of action by closing the isolating cocks on the corresponding engine control box, and the trouble investigated. The oil pressure lights also glow as the result of an engine stopping due to lack of water in the cooling system.

Car Lighting and Engine Starting Current

Electricity for lighting, engine starting, engine control, and air compressors, is provided by two Stone's Tonum 125-amp. generators, each driven from one of the power transmission shafts by three endless vee belts of the Texrope type. Control of the output is by Stone's dynamo field regulators with which are combined cut-in and light switches. The 12-cell batteries are of Chloride manufacture and are composed of special Exide Ironclad cells, in wrapped ebonite boxes, of 390 amp.-hr. capacity at the 10-hr. rate.

One of these equipments is installed on each of the outer cars of the train and supplies the lighting on the outer coach and on one half of the centre coach. Lighting throughout the train is under the control of the guard from either guard's compartment, and is in two circuits, with the lights in groups of two bulbs down each side of the ceilings. Current for engine starting on the centre car is provided by a bus-type generator driven from one of the propeller shafts on this car, the battery being of the same type and voltage as on the outer cars, but of 210 amp.-hr. capacity.

Car Bodies and Underframes

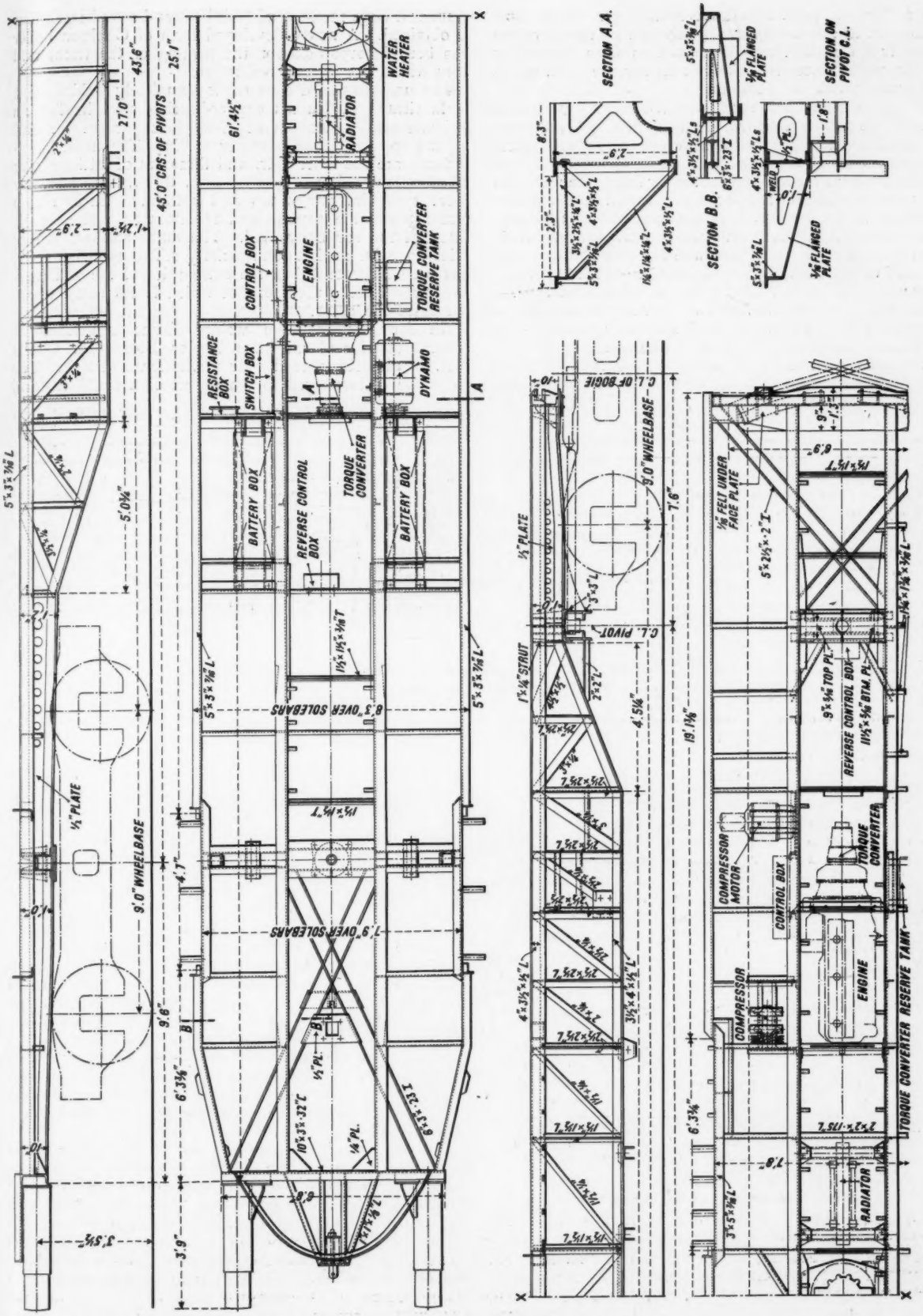
The body framing is of the timber type with outer panel plates of steel sheets welded together by the carbon arc process before being screwed to the timber framing. The carlines are of timber-filled steel construction bolted to the cantrails, and the steel roof sheets are secured to these by arc welding. The teak pillars of the body are bolted into steel pillar brackets welded to the solebars. The floor is made up of 18 s.w.g. dovetail steel sheeting welded to the level top of the underframe, and is overlaid with J. W. Roberts's Nonpareil cork, and with felt, and linoleum.

Interior of first class compartment

Air operated Alpax sliding doors give access to the interior, and these are under the control of the guard. They are interlocked with the engine control so that the driver cannot start the train while any sliding door is open. Passenger control push switches are fitted to the doors so that they can be opened by the passengers, provided the guard has previously set the control for this purpose. The door motors are mounted below the seats adjacent to the entrance bulkhead, and these particular seats are arranged longitudinally instead of transversely.

The interior of the cars is panelled in veneered three-ply, and all partitions have been made hollow for the sake of lightness. The veneers in the third class are figured white birch above the waist level and West African cherry mahogany below, with mahogany framing timbers. In the first class the panels are veneered in Pacific quilted maple above waist level and Circassian walnut below. In this class a pleasing effect is obtained by the use of decorative mouldings in satin finished aluminium alloy.

All the transverse seats except those against cross-partitions are of the throw-over type. They are mounted on chromium-plated steel tubular frames made by G. D. Peters & Co. Ltd., and have Dunlopillo fillings; the trimmings are in uncut moquette in shades of blue and brown for the first class and in fawn and brown for the third class. The seating layout and capacity are shown on one of the diagrams accompanying this article. A large number of the interior fittings, such as luggage rack brackets, door handles. torpedo ventilators, heater



Underframe of end power car of L.M.S.R. six-engined diesel-hydraulic train

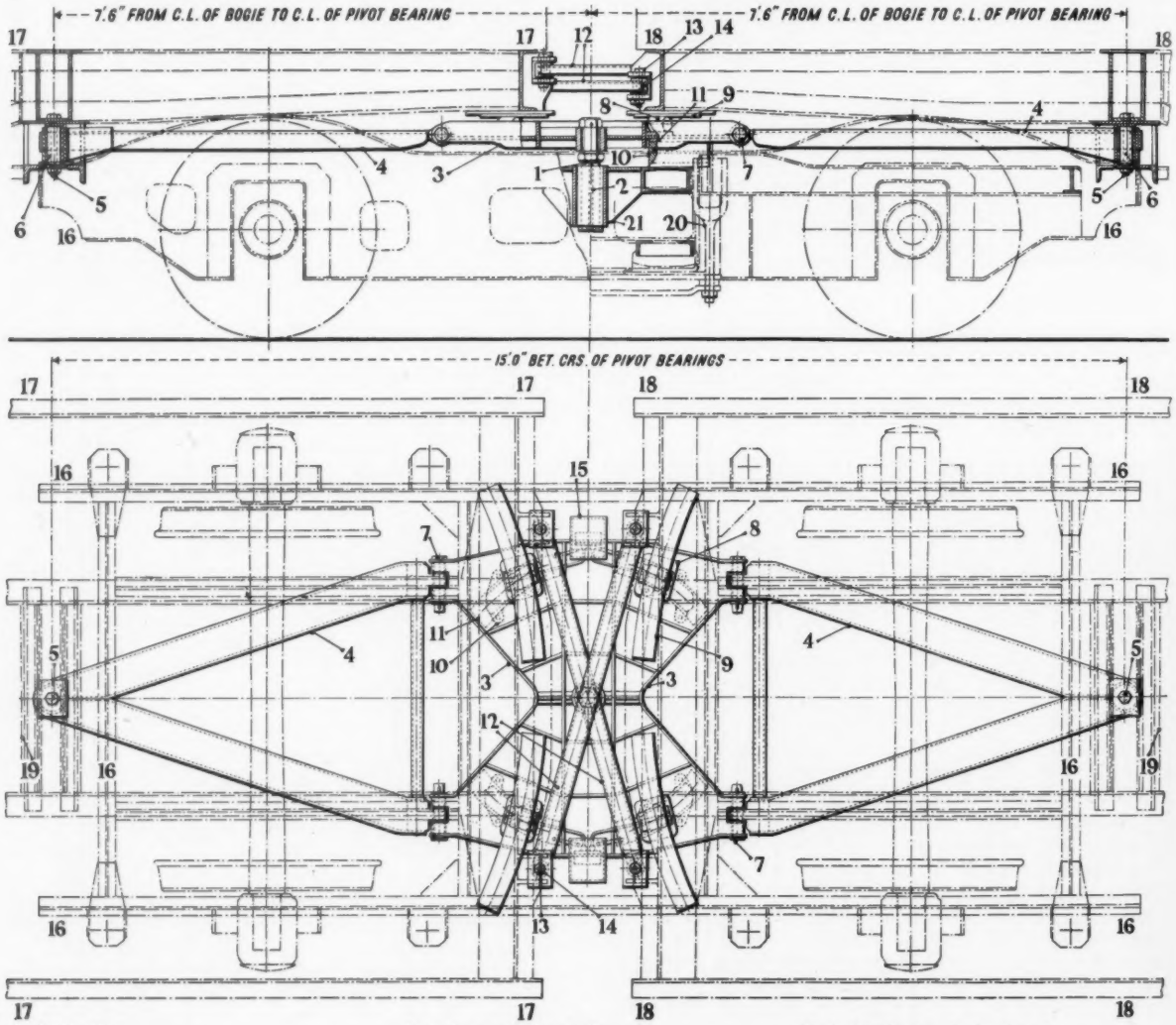
casings, curtain rails, decorative mouldings, and window fittings are of aluminium alloys supplied by the Northern Aluminium Co. Ltd. and these fittings were treated by the Aluminite process. Bakelite ashtrays are fitted to the side panels below the windows.

Sliding ventilator lights made by Worcester Windshields Limited are mounted above the fixed windows, and they are supplemented by torpedo extractors in the roof. Most of these communicate with the interior of the body, but several are used for ventilating the air spaces between the outer roof panels and interior ceiling finish. In this way condensation on the insides of the steel panels is reduced to a minimum. Three lavatories are provided, and have green painted walls and aluminium alloy mouldings. Hot and cold water is available, and the hot water is provided by means of a water heater of the Westinghouse type.

The under surface of the flooring near the engines is insulated with Roberts's Limpet sprayed asbestos $\frac{5}{8}$ in. thick, and elsewhere $\frac{1}{4}$ in. thick. The inside surfaces of all the valances, body sides, and roof panels are sprayed with Limpet asbestos to a thickness of $\frac{1}{4}$ in., and in this manner a large measure of both heat and sound insulation is obtained. A newly developed form of Clarkson boiler has been incorporated for the heating of the train, and goes within a very confined space.

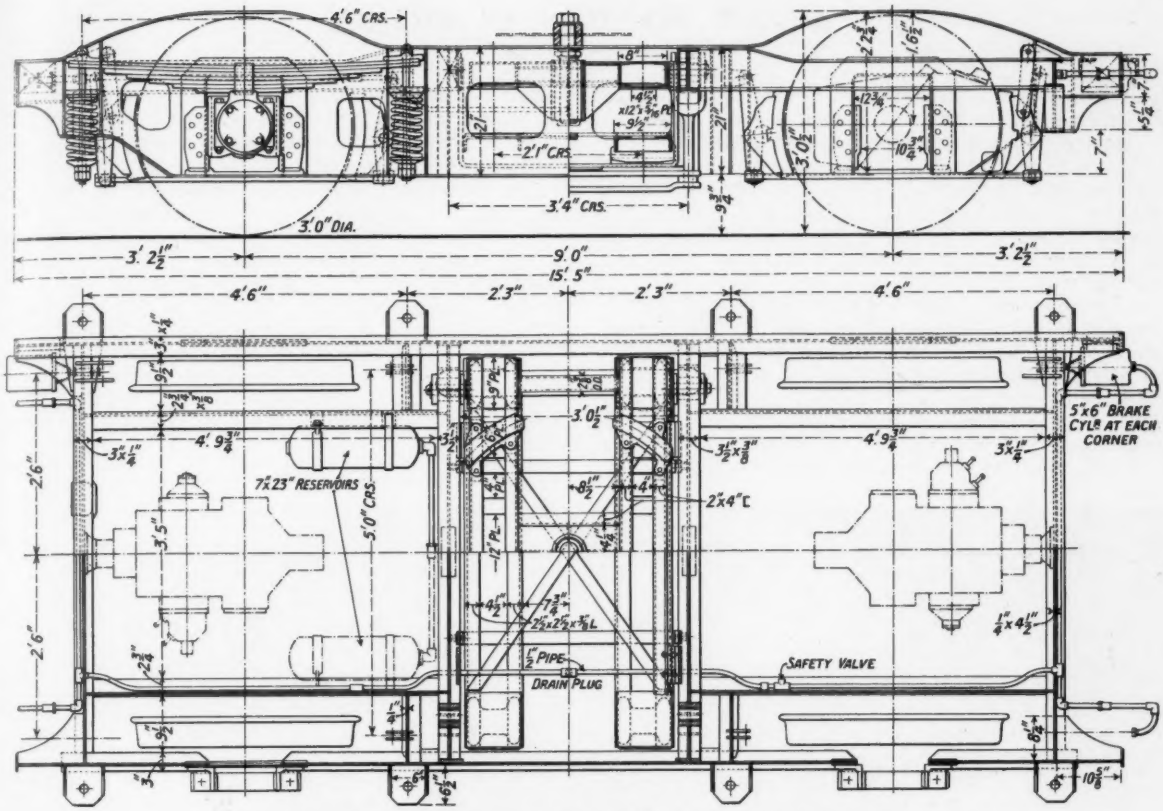
The underframe of each car is completely welded, and is fabricated of Kuplus copper-bearing steel having an ultimate tensile strength of 37-43 tons per sq. in. and a yield point of 22-23 tons per sq. in. The main longitudinals are the inner pair, and these are of lattice girder construction with a depth of 2 ft. 9 in., and 5 in. by 3 in. by $\frac{7}{16}$ in. angles top and bottom. These centre girders carry the engines and radiators as well as their share of the car body load. The outer solebars are of 5 in. by 3 in. angles. Particularly stiff diagonal bracing has been incorporated at the extremities of the end cars, two girders being used, one of which is cut away where it crosses the other.

All four bogies have welded frame structures of Kuplus steel, and all have Taylor Bros. disc wheels 3 ft. in diameter spread over a wheelbase of 9 ft. The axles are hollow-bored to the extent of 2 to $2\frac{1}{2}$ in. and



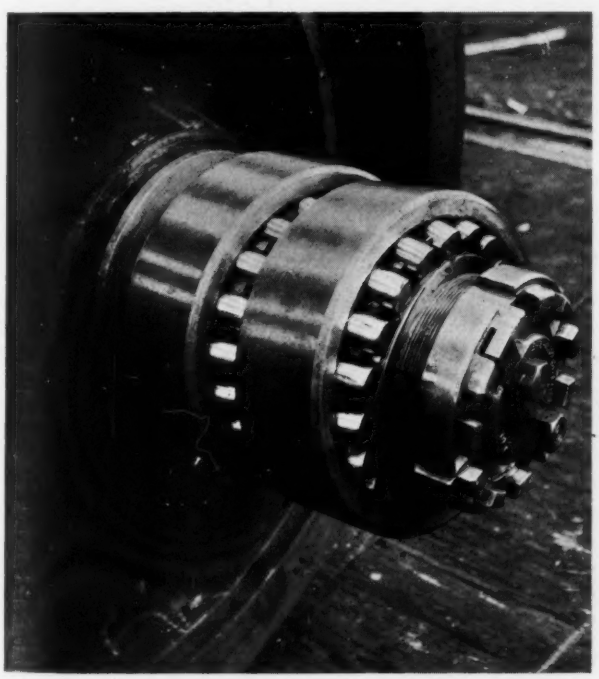
1—Centre pin
2—Silentbloc bearing to centre pin
3—Articulating link (centre section)
4—Articulating link (end section)
5—Pivot pins to links
6—Silentbloc bearing to link pins
7—Pins to knuckle joints
8—Roller support to underframe
9—Race plate to roller support
10—Bogie bolster friction block
11—Friction plates to friction block
12—Centring rods
13—Pins to centring rods
14—Silentbloc bearings to centring rod
15—Lubrication to roller bearings, &c.
16—Articulated bogie
17—Framing members to first car
18—Framing members to second car
19—Supporting frame to pivot bearing
20—Swing beam to bogie
21—Bogie centre framing

General arrangement of articulation system



General layout of non-articulated bogie, L.M.S.R. diesel train

are carried on S.K.F. roller bearings supported by independent overhung laminated springs. Helical steel auxiliary springs are fitted round the hangers and they are encased in light steel covers. Helical springs also support the welded steel bolster. The Westinghouse brake is of the self-lapping automatic type and applies two blocks on each wheel through clasp rigging. The brake blocks have Ferodo linings. Individual cylinders, 5 in. in diameter, are used for each wheel, and the amount of brake rigging thereby is considerably reduced. There is a handbrake in each driving position, and it applies the blocks on the adjacent bogie only.



S.K.F. axle roller bearing

In the system of articulation used to connect the centre vehicle to the other two, four rollers are used to carry the weight of the two underframes and transmit it to the bolster, and the pivoting is carried out through two pins (*5* in the drawing) located on the underframe above the extremities of the bogie frame structure. These two pivots are connected by a long link system consisting of the links *4* and the welded steel centre member *3*, which to allow of relative vertical movement are connected by the knuckle pins *7*, and the centre structure also is pivoted to the bogie through the centre pin *1*, carried in a Silentbloc bushing *2*. The end pivot pins *5* and the pins of the centring rods *12* also are carried in Silentbloc bushings.

BUGATTI MILEAGE.—Between December 22 and January 4 last passenger traffic increase on the Lyons-Strasbourg route led the erstwhile P.L.M. Railway to put on the Renault 500 b.h.p. twin-car trains which normally work the up fast morning service from Lyons to Paris and return in the evening. During this period the two up and two down fast daily services between Paris and Lyons were shared by the three Bugatti double-car sets, and the average aggregate daily mileage was 1,275 miles at start-to-stop speeds of 60 to 72 m.p.h.

RAILCAR SERVICES IN FRANCE

*By LUCIEN DUMAS**

DURING the past six years the French railways have ordered 800 railcars; of this total 660 are already in service and 140 are under construction. The 660 cars in operation cover 90,000 miles each day, equivalent to 23½ per cent. of the total daily mileage of steam trains in France. In numbers, France heads the European list; Germany follows, a close second, with 640 railcars, then come Czechoslovakia with 500, Italy with 460, and Roumania with 220.

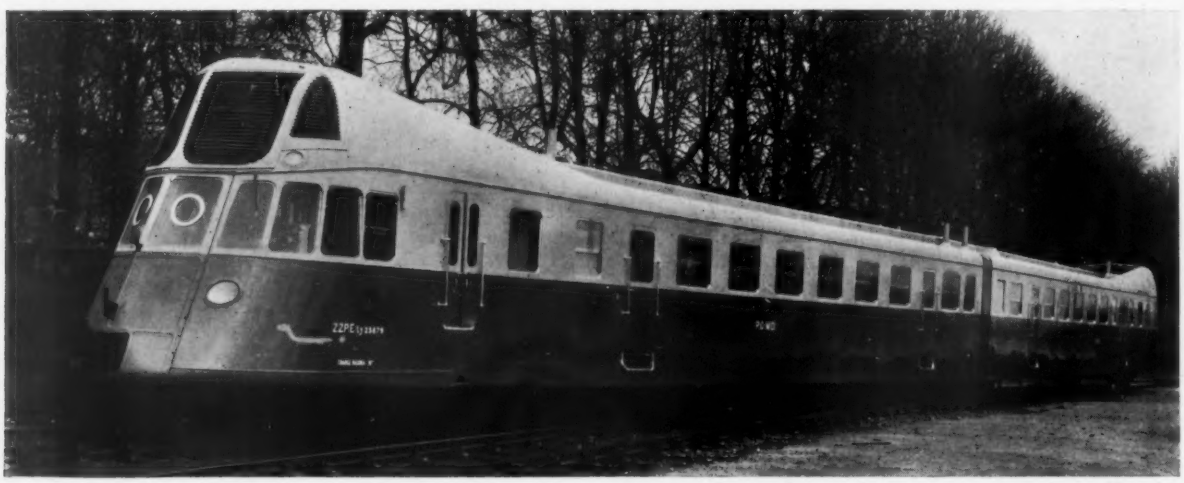
Engines of more than 100 b.h.p. small and light enough to be used in railcars could not be found in France some years ago, but now Renault, Saurer, and C.L.M. have built and perfected engines of 300 b.h.p. Some of these firms have built engines of 500 b.h.p., *e.g.*, Renault, and C.L.M. have on the test bed a 500-b.h.p. horizontal engine which weighs less than 9 lb. per b.h.p. It was at the request of the French railways that the constructors developed the diesel engine in preference to the petrol type, with a view to benefit by the oil engine's higher efficiency and to reduce the danger in case of fire.

It seemed at first that electric transmission would be preferable if the hydraulic system could not be sufficiently improved, but contrary to expectation, mechanical transmission came to the forefront. It is today the lightest, the surest, and the cheapest. Mechanical transmission for 300 b.h.p. is perfectly satisfactory, and mechanical transmissions for 500 b.h.p. have been realised, and are used notably on certain Renault cars.

In order to facilitate and to hasten the development of the railcar so that reliable service might be assured, the French railways did not hesitate to order something like 50 or 60 different prototypes. The financial sacrifice occasioned by the production of so many models has been fully justified, and orders can now be placed with all confidence for series of railcars most suited to the particular service. About £5,000,000 has been spent over a period of some five years in the perfecting and acquisition of railcars in France.

Contrary to what might be expected, it was not necessary to have a large number of different types of railcar to meet all the needs of the service. Small railcars with low maximum speeds for branch lines, special railcars for omnibus services, with, say, a maximum speed of 55 m.p.h., special cars for main lines, with top speeds of 75 m.p.h. or so, and railcars with great seating capacity for peak periods are unnecessary. The railcar must be suitable for almost any service. For peak loads two or three cars must be coupled together in multiple-unit.

At one time it was considered that the railcar would be used mostly for supplementary services, thus giving a frequent service and bringing back the public to the railway. Happily for the expenditure, this is not now usual. The present practice is often to replace steam trains by railcars, and at the same time to give extra services if required. It was also thought that high-speed railcars or diesel trains would assure certain supplementary long-distance runs, and would be incapable of replacing steam trains. But it was found that the public took readily to high-speed railcars, and now a number of fast railcar or railcar-train runs are made daily between Paris and Le Havre and between Paris and Lille. Between Paris and Lille the Franco-Belge triple-car diesel trains make three return trips daily, while steam trains give the same number of services at a rather lower speed. Fast railcars have also enabled the cross-country services to be greatly improved, *e.g.*, from Dieppe to Nantes, from Lyons to Strasbourg, from Bordeaux to Clermont and thence by another car to Lyons.



600 b.h.p. twin-car Renault diesel-mechanical train

Working Costs

The chief elements of operating costs are the expenditure for maintenance and repairs, and the amortisation. These two form about 75 per cent. of the operating costs, and thus the cost per mile is nearly the same for different types of railcars, so long as they are perfected models with similar capacity, power, and speed. Nowadays, engines can easily run 40,000 to 50,000 miles before needing complete dismantling, and the mileage of a railcar between two general repairs normally reaches 100,000 miles. The complete working costs—amortisation and general expenses included—of 200-300 b.h.p. single unit cars in general use on main and branch lines for slow or semi-fast services, are about 50 to 60 per cent. of the working costs of corresponding steam trains. With prices current in France in 1936, the railcar operating cost is equivalent to 4·0 to 4·5 fr. per km.

* In a paper read before the Institution of Locomotive Engineers.

LUXURY DIESEL TRAINS FOR ARGENTINA

State Railways acquire triple-car sets mainly for tourist traffic

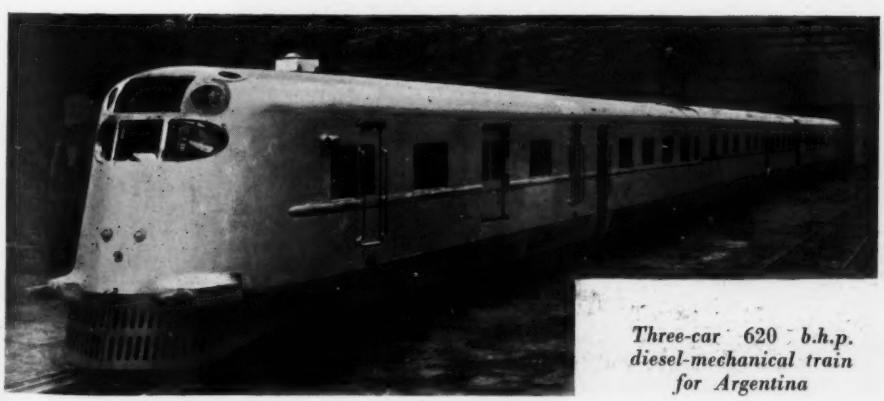
AMONG the 42 railcars and trains now being built for the Argentine State Railways by Ganz & Co. Ltd., of Budapest, are two three-car diesel-mechanical trains for broad gauge lines which present several interesting technical features. They are to be used on the long Bariloche line, which serves at one end a mountainous region of great natural beauty which is much frequented by tourists both in winter and summer. These new triple-car trains will cater mainly for tourist traffic between Viedma, on the Atlantic coast, and the Bariloche National Park area in the Andes.

There are a number of climatic and physical difficulties at various parts of this 500-mile line which have complicated both the design and operation. In the first place, the prairie region of Rio Negro is extremely cold in winter, the lowest temperature reached being – 4° F., but in summer the temperature rises to 85° F. in the shade. Very strong west winds are encountered and great quantities of fine dust are blown over the track and generally penetrate into ordinary carriages. Moreover, the track is mainly earth ballasted, requiring a careful design of the car suspension, and the axle load is limited to 12 tons. By reason of the traffic, semi de luxe equipment is necessary, and to that end air-conditioning and convertible sleeping compartments and day coupés are incorporated.

Interior Equipment

The layout of the trains can be seen in one of the accompanying diagrams, and it will be noticed that each end car has a power-transmission plant on the outer bogie. The train is not articulated, and on occasions of light traffic there is no reason why the central car should not be withdrawn from the rake. Nominally, only one class of accommodation is provided, but there are seven four-seater coupés giving semi de luxe travel during the day, and which are at night converted into two berth sleeping cabins. The beds are folded up vertically into a narrow frame against the corridor wall during the day, and at night the table and four chairs, all with stainless steel tubular frames, are folded up and pushed beneath the beds. A kitchen and buffet are included in the train, and portable tables can be fixed between the seats in the big passenger saloons for the serving of meals. The kitchen has a gas-fired range, and its entire equipment is made of polished non-rusting steel and chromium-plated non-ferrous metal. Aluminium lining is used for the kitchen panels. In addition to the lavatories there is an unusual form of toilet room with wash basins arranged side by side along the wall of the car.

In view of the temperature range and atmospheric conditions special attention has been given to the heating and ventilating equipment. Each of the two end (power) cars is fitted with a Ganz air conditioner of the Freon type, which supplies the interior of that car and also half of the middle car with fresh, clean and filtered air and ensures proper air circulation. In cold weather it is operated in conjunction with the heating system. Fresh air is first taken in at the roof of the leading car just above the driving position; the engine induction air also is taken in at the same place, and an amply-dimensioned duct along the ceilings of the three cars ensures that air is led to the rear engine and also to the fresh air fan of the rear car. The circulating fresh air is first driven by fans through the air conditioners located below the power car floors, and in its purified form is introduced into the



Three-car 620 b.h.p. diesel-mechanical train for Argentina

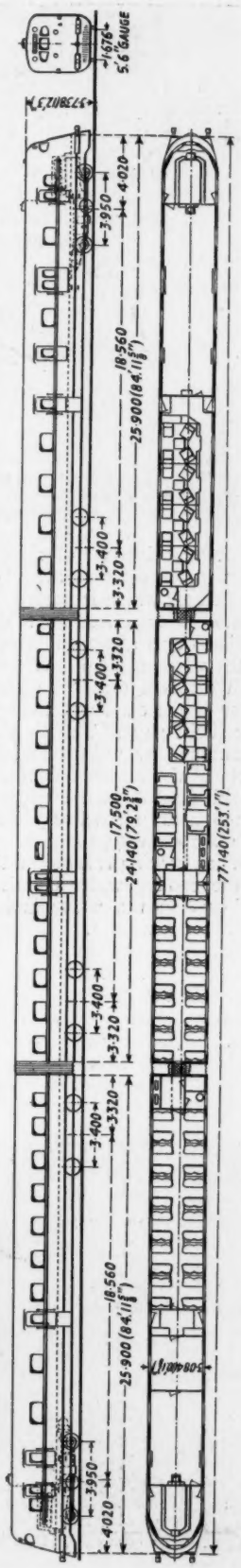


Diagram of three-car Ganz train for the Bariloche line of the Argentine State Railways

Left: Interior of coupé by night, showing bedframe lowered from wall next to corridor

Below: Interior by day, showing four separate chairs and table

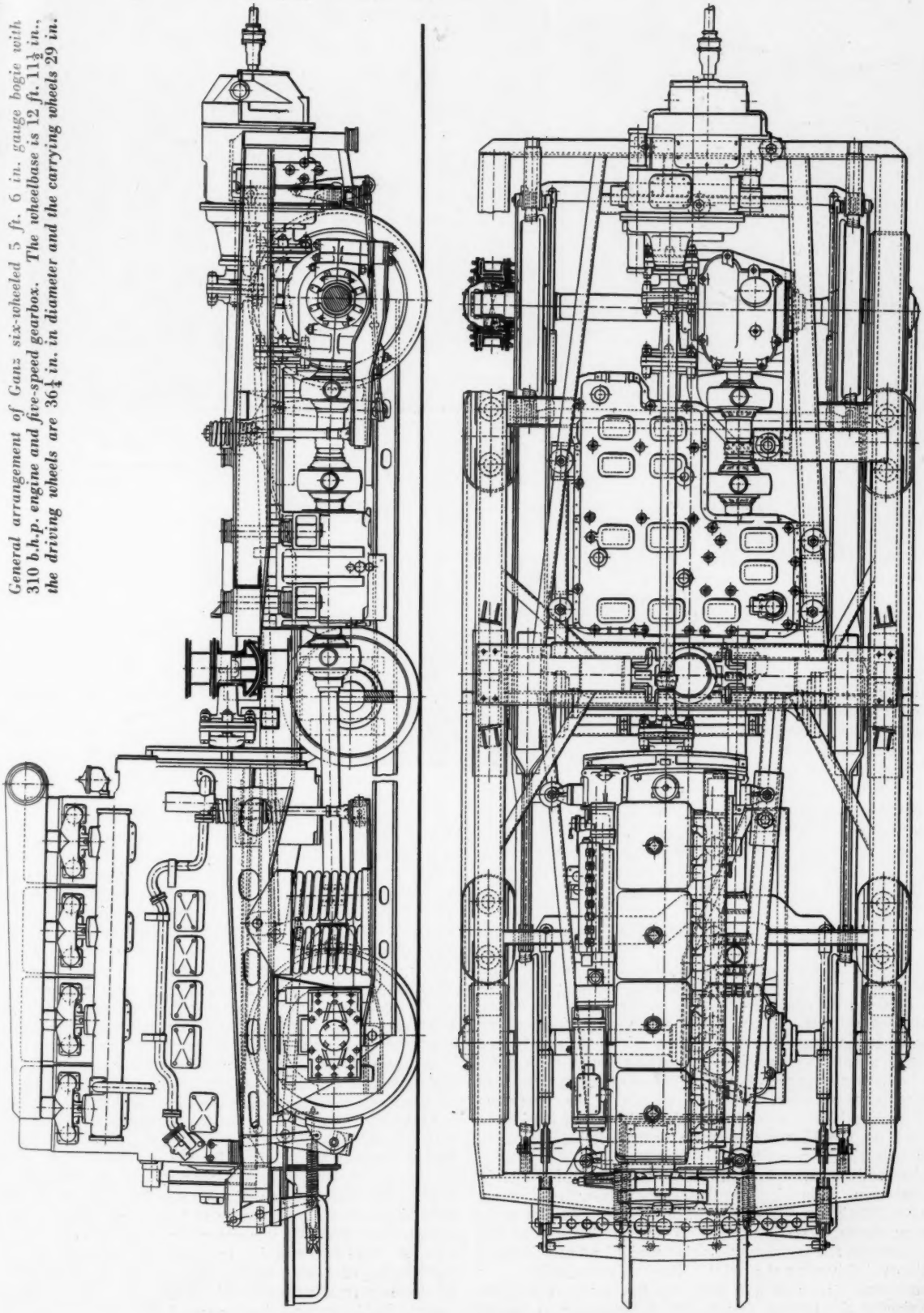
passenger saloons and compartments through filter-fitted ducts in the ceilings, after being mixed with re-circulated purified air which is passed through the air conditioner by separate fans. Used air is drawn off by the fans through suction ducts arranged below the seats. The adjustment of the whole system is effected so that the circulating and fresh air fans create a slight positive pressure in the interior of the cars, and thus prevent dust entering through any slight gaps. The air ducts are carried from one car to another by well-packed leather bellows. The suction ducts of the air-conditioning system are not connected to the kitchen or to the luggage and postal compartments, although the air delivery duct is led into them and fitted with a regulating damper.

When heating is required the air-conditioner is connected to the cooling water circuit of the adjacent engine, and the heat in the water is imparted to the air by gilled tube elements. If the engines are not running, particularly before the train starts, hot water is supplied by an oil-fired boiler located in one of the two power cars. In the case of cooling, the heat-exchange air conditioner serves as an evaporator of the cooling agent liquefied in the cooling plant, whereby heat and moisture are extracted from the air. The Freon is compressed by a mechanically-driven compressor, liquefied in a condenser, and evaporated in the air cooler. The lighting equipment of the train is fed by two 5 kW. generators operated in conjunction with two 360 amp. hr. 24-volt batteries.

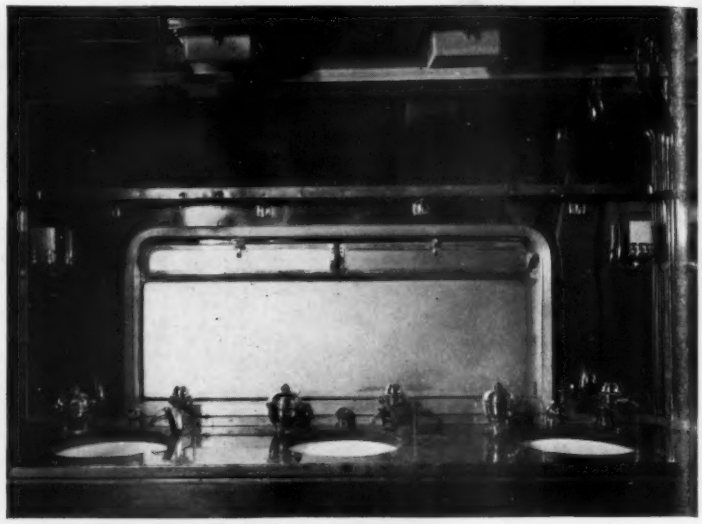
Bogies and Motive Power

Owing to the limitation of the axle load to 12 tons, it was necessary to make the power bogies of the six-wheeled type, mainly because of the natural concentration of weight resulting from the mounting of a 310 b.h.p. engine and five-speed mechanical transmission on the bogie. But in order to ensure easy riding over the existing curves the bogie wheelbase had to be kept to the original standard figure of 12 ft. 11½ in. (3·95 m.). Moreover, as both the end and central axles are erected without lateral or longitudinal play, following the construction of the usual Ganz non-swing-bolster bogie, the centre wheels were given cylindrical treads without flanges, so that they take no part in the guiding of the train, and as they are almost exactly below the bogie pivot they can take up almost the ideal position on curves. Compared with a pair of flanged wheels, the flangeless type shows a reduced rolling resistance. Owing to the size of the driving equipment and the presence of a double-end drive from the gearbox, with cardan shafts leading backwards and forwards to the two driving axles, the centre axle had to be cranked, and was therefore made

Ganz six-wheeled driving bogie for 5 ft. 6 in. gauge trains. The eight-cylinder diesel engine is of 310 b.h.p. and behind the pivot is a five-speed gearbox, main clutch and reversing gears. The two outer axles of the bogie are driven



General arrangement of Ganz six-wheeled 5 ft. 6 in. gauge bogie with 310 b.h.p. engine and five-speed gearbox. The wheelbase is 12 ft. 11⅛ in., the driving wheels are 36¼ in. in diameter and the carrying wheels 29 in.



Above: Toilet room arranged down by side wall of the car

Above: The buffet in the new diesel tourist trains for the Argentine State Railways

Left: Ordinary passenger saloon in the new Ganz broad-gauge trains

of the fixed type with the wheels running loose on it, each wheel hub carrying two roller bearings. The axle is supported in special bearing members outside the wheels which are guided in pedestals welded to the main members of the bogie frame. The centre wheels are 29½ in. in diameter and the driving wheels 36¼ in. Double-row roller bearings are used for the driving axles and for the carrying bogie boxes.

Following normal Ganz practice, only helical steel springs and rubber pads are used for the suspension of the bogies. In the six-wheeled power bogies a spring beam connects all the axleboxes down each side and on this the bogie frame is supported by triple nests of helical springs, a double group being located close to each outer axlebox. Both types of bogies have frame structures of welded chrome steel. All the wheels of the carrying bogies and all but the centre wheels of the power bogies are braked on the Knorr automatic compressed air system, with two blocks per wheel.

The motive power installation at each end of the train comprises a Ganz-Jendrassik eight-cylinder engine set to give 310 b.h.p. at 1,250 r.p.m.; a multiple-disc main friction clutch; reversing gears; a Ganz gearbox giving five speeds up to the maximum track speed of 68 m.p.h.; and final bevel drives on the axles. The engine cylinders have a bore and stroke of 170 mm. by 240 mm. Owing to the size of the engine, it was found necessary to mount the main clutch and reversing gear on the inner headstock of the bogie, that is, behind the gearbox, whereas in the usual Ganz arrangement with smaller engines these two constituents are located between the engine and gearbox, near the bogie pivot. The drive is taken from the engine to the clutch and reversing gear and then forward again to the gearbox. The gearbox movements are made under electro-pneumatic remote control. Most of the auxiliary apparatus, including the engine cooling water radiators and their fans; compressors; generators; and air-conditioners are mounted on a special subframe below the end car floors, and they have a common primary drive from the reversing gears. A complete set of auxiliary apparatus is mounted on each power car. The compressors for the air-conditioning plant can be put in or out of gear by means of a remotely-controlled multiple steel coupling.

GERMAN INDUSTRIAL LOCOMOTIVES.—The A.E.G. is now building 185 b.h.p. diesel-electric four-wheeled locomotives designed specially for use in the brown coal industry. A five-cylinder four-stroke D.W.K. engine with Bosch fuel pump and a 16 h.p. Bosch starting motor provides the power. It runs at 1,025 r.p.m. and is direct-coupled to a 100 kW. generator having a maximum voltage of 620. The two traction motors have an individual one-hour rating of 65 kW. at 400 r.p.m. (550 volts), and produce a starting tractive effort of 20,000 lb. The locomotive weight is 32 tons and the top speed 18 m.p.h. A 400 amp.-hr. Afa battery and Knorr compressed air brakes are fitted.